MECHANIX ILLUSTRATED

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новое лучшее том 3

MAY

NAVY'S FLAPJACK MYSTERY PLANE
It Hovers Like a Helicopter! Will It
Fly Faster Than the Speed of Sound?
See Page 58

THE MAN WHO MAKES MONSTERS

BUILD A SOAP-BOX DERBY WINNER SEE PAGE 112

mechanix illustrated

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Photos by Louis Hochman

Navy's Synthetic War

These amazing devices, simulating actual warfare, save millions of dollars in training our fighting personnel.

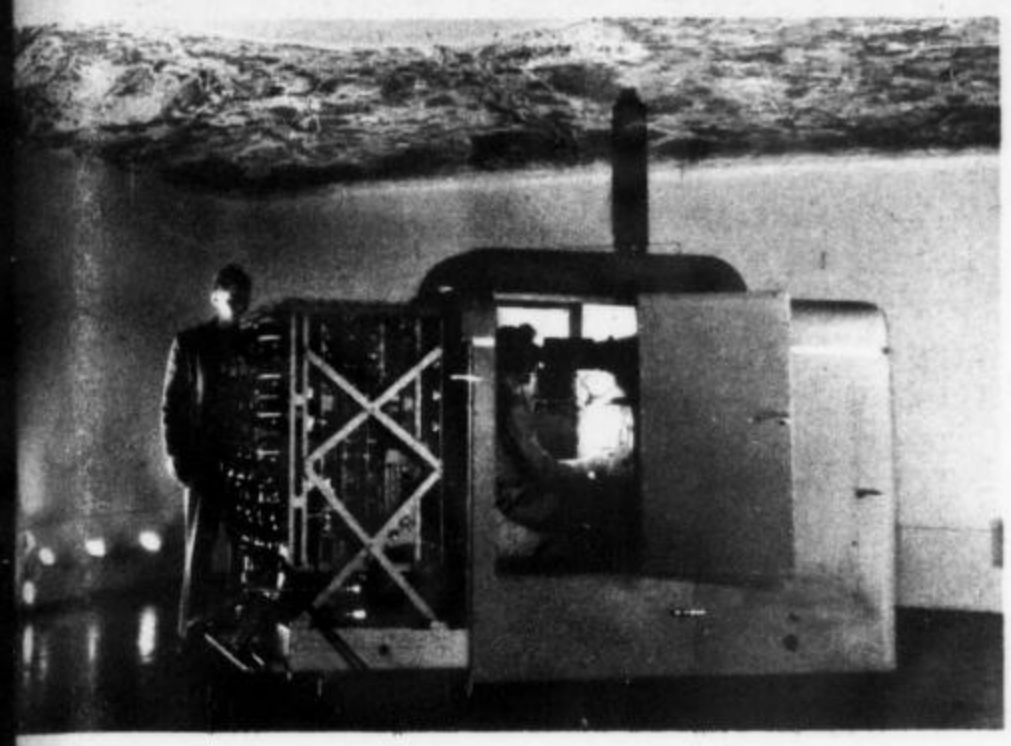
BY DON ROMERO

A BLOODLESS war is being waged at Sands Point, New York. Planes are roaring off landing strips, reconnaissance ships are scouting enemy terrain, radar-guided fighters and bombers are strafing and bombing enemy installations, and submarines are sinking enemy vessels. But let's go back a little.

In the early days of World War II, when the Navy was frantically wondering how it could speedily train raw recruits to operate the intricate machines of modern war, civilian inventor Luis De Florez announced he could solve the problem with "synthetics"—special devices by which men could be trained to operate the Navy's ships, planes, and guns under conditions simulating those of actual warfare. Skeptically, the Navy gave De Florez a technical staff and told him to go ahead. Today, almost two years after the end of the war, De Florez's "Special Devices Center" is not only still in existence but it is operating with a bigger staff than it ever had during hostilities.

Located at the 163-acre Daniel Guggenheim estate at Sands Point, Long Island, its 350 engineers and technicians, working in a building which formerly stabled the Guggenheim's riding horses, are now turning out bigger and better synthetics which are saving hundreds of lives and millions of dollars in the training of the Navy's fighting personnel.

One of the simplest yet most effective devices recently turned out is the Primary Flight Trainer. Over a stationary cockpit, equipped with a "stick," foot pedals, and



Left: There's a real sensation of flight when the student views this replica through the periscope at top. The scene which appears to be below the student is actually on the ceiling as shown in the above photo of the Contact Flight Trainer.

throttle, is a horizontal beam with a counterbalanced model plane dangling from one end, a few feet in front of the student. By means of the cockpit's controls, the student can regulate the speed of the model's propeller, and also manipulate its ailerons, elevators, and rudder. Under the model is a canvas endless belt simulating a landing strip.

In a take-off, this belt is set to revolving under the model's wheels and the student, seeing the "landing strip" rush toward him as it would in an actual take-off, has the problem of getting the model smoothly into the air. Once he is "up," he puts the model through climbs, dives, and banks in response to his instructor's commands. Being delicately counterbalanced, the model is so dependent for flight upon the actual pull of its propeller that should the student use insufficient power, the model can actually "stall out" in a steep climb, or "side slip" in a sharp bank. When he brings the ship in for a landing, the belt is again made to revolve, and the student is required to put the ship down without "nosing over" or toppling over on one wing.

A similar, but considerably more complicated synthetic is the Contact Flight Trainer, an electro - mechanical - optical device which in addition to training novice flyers can be used to familiarize trained flyers with actual terrain.

The trainer consists of an enclosed, wheel-mounted cockpit which rolls over a perfectly level steel floor. On the ceiling overhead is a colored relief map, accurately scaled one foot to the nautical mile, and reproducing a large section of terrain. Inside the cockpit is a "stick," throttle, dashboard, and machine-gun button. Protruding from the top of the cockpit is a periscope which is aimed straight at the ceiling, and which can be raised, lowered, or revolved 360 degrees. At the bottom of the periscope are eyepieces through which the student peers while flying his "ship."

In putting the ship into flight, what the student actually does is to send the cockpit rolling forward, so that when he looks at the relief map through the periscope, he gets the illusion of actually flying. His "altitude," of course, is determined by the distance of the periscope's "eye" from the ceiling.

If he goes into a dive, the student suddenly sees the ground rushing up toward him, the illusion being created by the periscope automatically rising toward the ceiling. If he goes into a climb, he sees the ground recede, the illusion being created by the periscope receding from the ceiling. If he banks right or left, or even goes completely over on his back, the periscope makes the necessary illusionary accommodation so that optically the student always gets the impression of being in whatever position he has set his controls for.

The realism of flying, however, isn't confined merely to the optical. When he speeds up his prop, the engine's roar grows louder. When he presses his firing button, he hears the bark of his machine guns. And when

Below: In the Sub Attack Trainer, a student seeks out and attacks an enemy "tin fish" controlled by the instructors. The periscope is the real thing.

he goes into a climb, his controls become harder to work. In fact, so realistic is the entire illusion of flying that students practicing on the trainer have at times been known to become airsick. One of the invaluable features of the trainer, especially in time of war, is that from aerial photographs, technicians can create and install a contour map of enemy terrain in a matter of hours.

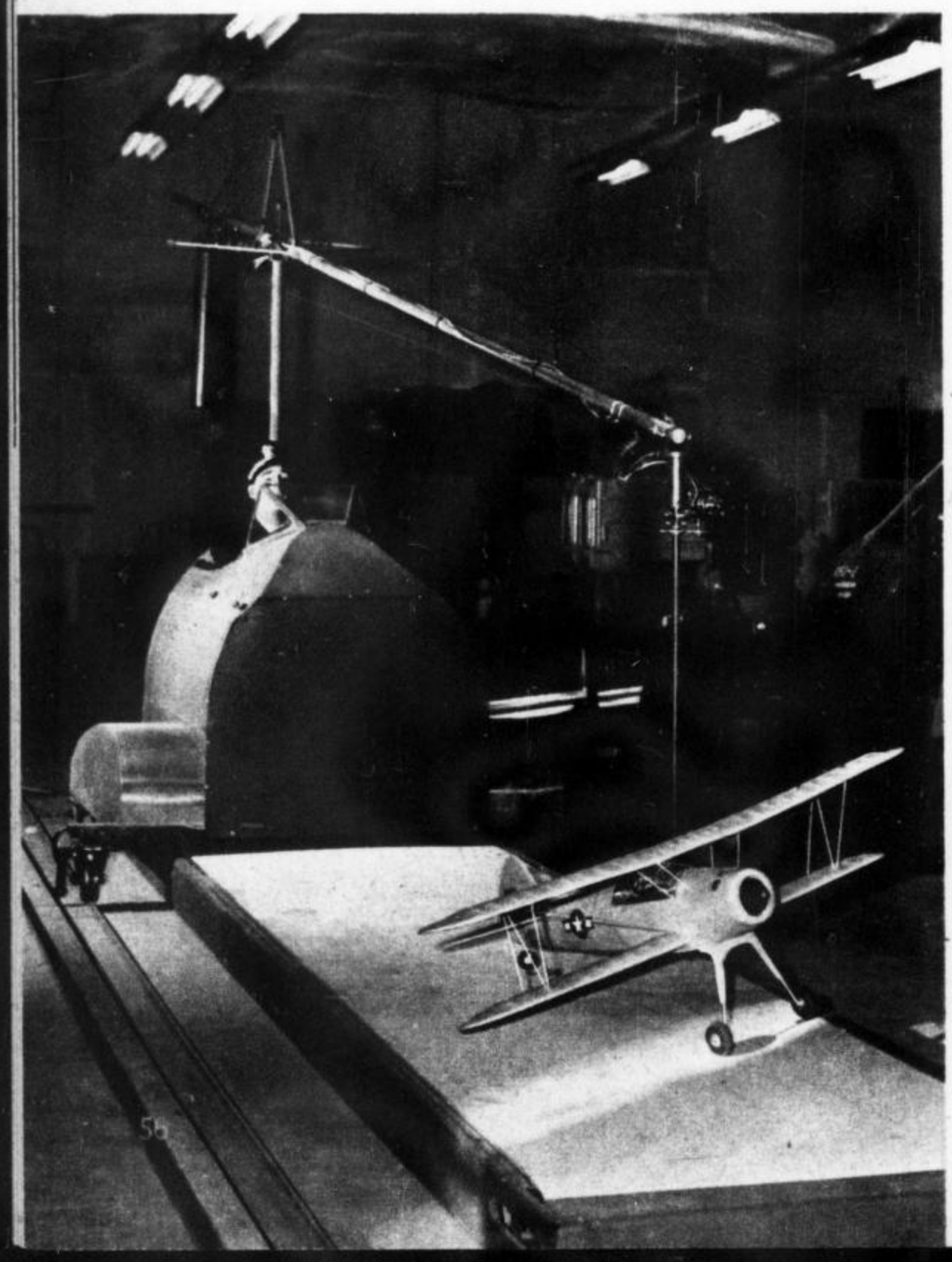
An entirely different type of synthetic is the Loran trainer, which is used for instructing seamen and pilots in making long-range navigation computations from radio signals. Most of the world's ocean surface is divided into four sections, each of which is serviced by eight pairs of Loran radio stations.

When a navigator, seeking to establish his position, gets a signal from one pair of stations, he uses an oscilloscope for converting this signal into a reading in microseconds. On his Loran map he then finds a long curved line bearing this same microsecond reading. Getting another signal from a second pair of stations, and again converting it into a microsecond reading, he finds another curved line on his map bearing this second reading. All he has to do then is to note where the two lines cross and he has his navigational position.

However, to train navigators in the very tricky business of making accurate readings from their scopes, engineers have developed a synthetic which reduces thousands of square miles of open sea to a map about 15 by 6 feet square and which for purposes of accuracy employs high-frequency-sound signals, which travel at only 1,087 feet-per-second, in place of radio signals, which travel at 186,000 miles-per-second.

Using a small sound receiver to denote a ship or plane, and four small sound generators to denote two pairs of Loran radio stations, the instructor moves the receiver to any point on the map and then begins to bombard it with sound signals. Upon being picked up by the receiver, these signals are instantly converted into electrical impulses so as to appear as microsecond readings in the student's scope. From these readings, the student is required to quickly determine the position of his ship or plane, his answer being easily checked by the instructor who merely has to note where the receiver actually lies on the ocean map.

A somewhat similar synthetic, designed to train pilots in the use of radar is the Ultrasonic Radar Trainer. As in the Loran device, this instrument employs high-frequency sound which, however, is sent through water so that it will move only 1/200,000ths as fast as radar waves move through air. The trainer consists mainly of a comparatively small scale relief map, which is covered with six inches of water in which the sound generator, denoting the plane, is completely immersed. In radar, the transmitting antenna on a plane revolves once every six seconds and constantly sends out a beam in a three-degree arc. The sound generator does the same thing, except that it sends out a beam of sound rather than one of electricity. Also in radar the pilot uses a scope in which an arm of light revolves in simulation of the revolving radar beam which the plane is sending out. When this beam picks [*Continued on page* 79]



Left: With the simulated controls, trainee attempts to land the plane on the moving belt in front of him.

Pilot and observer have almost perfect visibility, including straight down and aft. Rear seat can be swiveled at will.

"Versatility on wings" describes the Army's new liaison plane, the L-15A, above. It can loaf at 36 mph, sprint up to 112, and dive at 200.

new eye in the sky

THE Army's new observation plane, the Boeing L-15A, is the first plane designed specifically for battlefield observation and artillery spotting. Its importance is signalled by the fact that during the war even the use of Cubs and Grasshoppers—designed originally for ordinary citizens who liked to go flying on weekends—became so effective at locating enemy targets that from D-day on 75 per cent of all observation work for the big guns was done by these light personal planes. But a different type of plane had to be used for each job, and at the end of the war no one plane had been developed that would fit all requirements. To meet those needs, Boeing has turned out the all-purpose L-15A shown here.

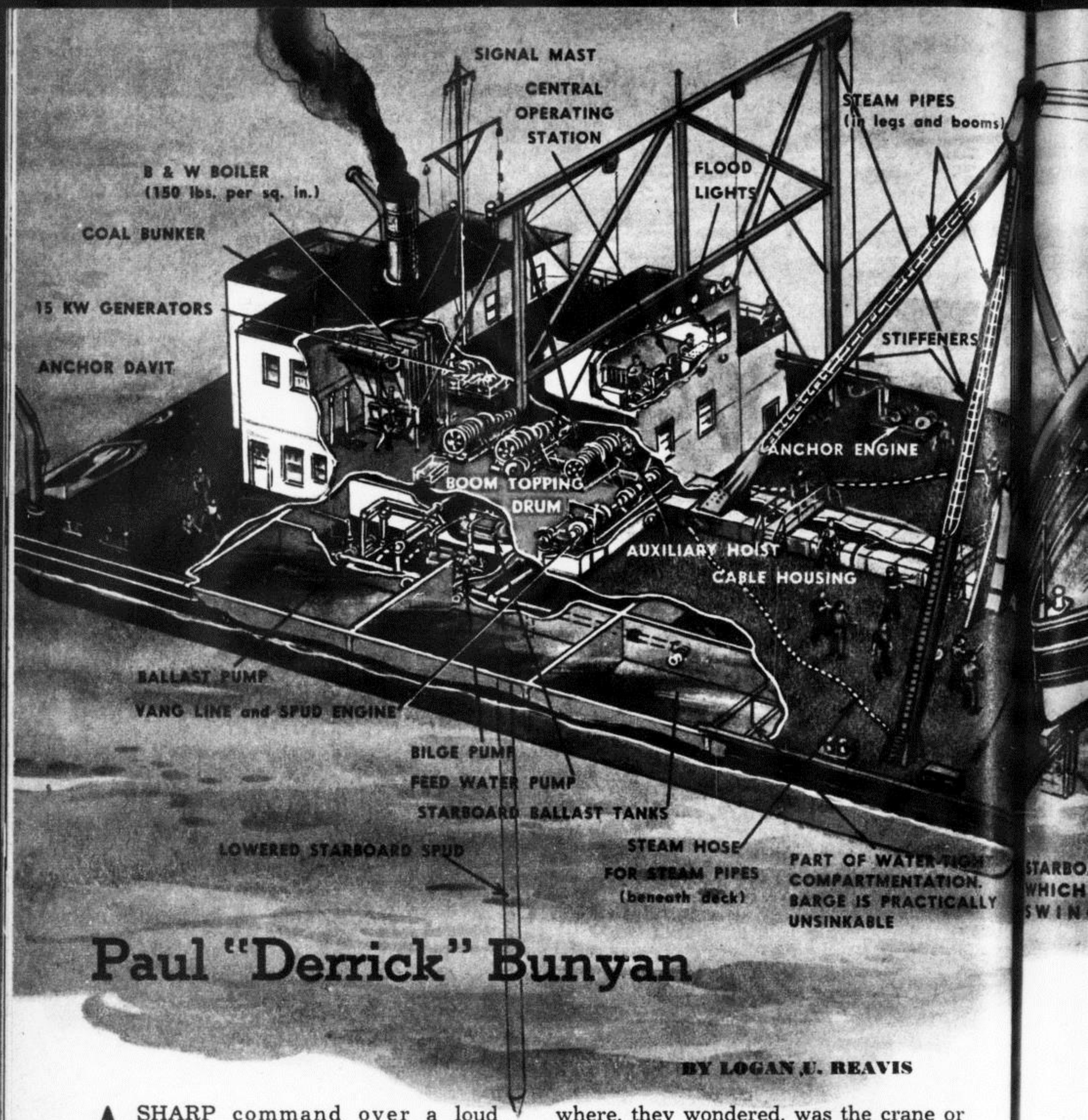
This new "eye in the sky" is a two-place, all-metal monoplane powered by a single 125-hp Lycoming engine. With this low horsepower, the ship can produce an amazing set of performance statistics.

It can take off and clear a 50-foot obstacle, equivalent to a four-story building, in a distance of only 595 feet. It can come in over the same building, land, and roll to a full stop in 517 feet, and with no obstacle in the way it can land and stop in 247 feet.

Visibility, of course, was a prime consideration. In the L-15A, the pilot and observer have a sweeping, all-around view, including directly below the plane and directly aft. The observer's seat may be swiveled about so that he faces the rear.

The plane can remain aloft at speeds as low as 36 mph and it can jockey in for a landing at 32 mph.

Left: Full cantilever type tricycle gear permits rough landings. Wheels can be replaced with floats or skis.



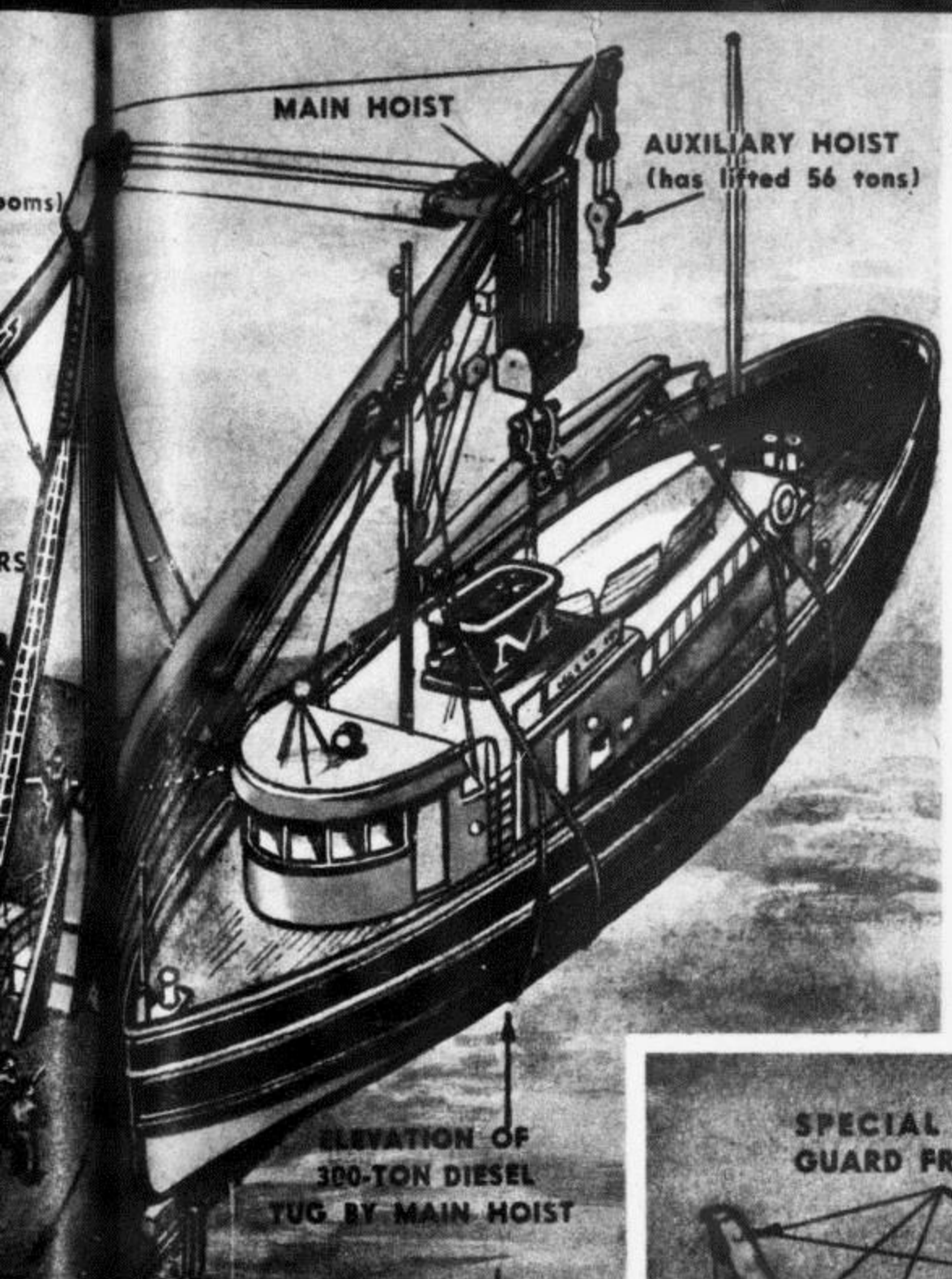
Paul "Derrick" Bunyan

BY LOGAN U. REAVIS

A SHARP command over a loud speaker, the sudden straining of steel cables over sheaves, and a giant arm slowly, steadily, lifts a tremendous weight higher and higher into the air. Paul Bunyan, legendary Hercules of the North Woods, "rides again"—his muscles the powerful drums and cables of the mighty floating derrick created by the Army's Corps of Engineers to serve the vital "Soo" locks, critical bottleneck connecting Lake Superior and Huron.

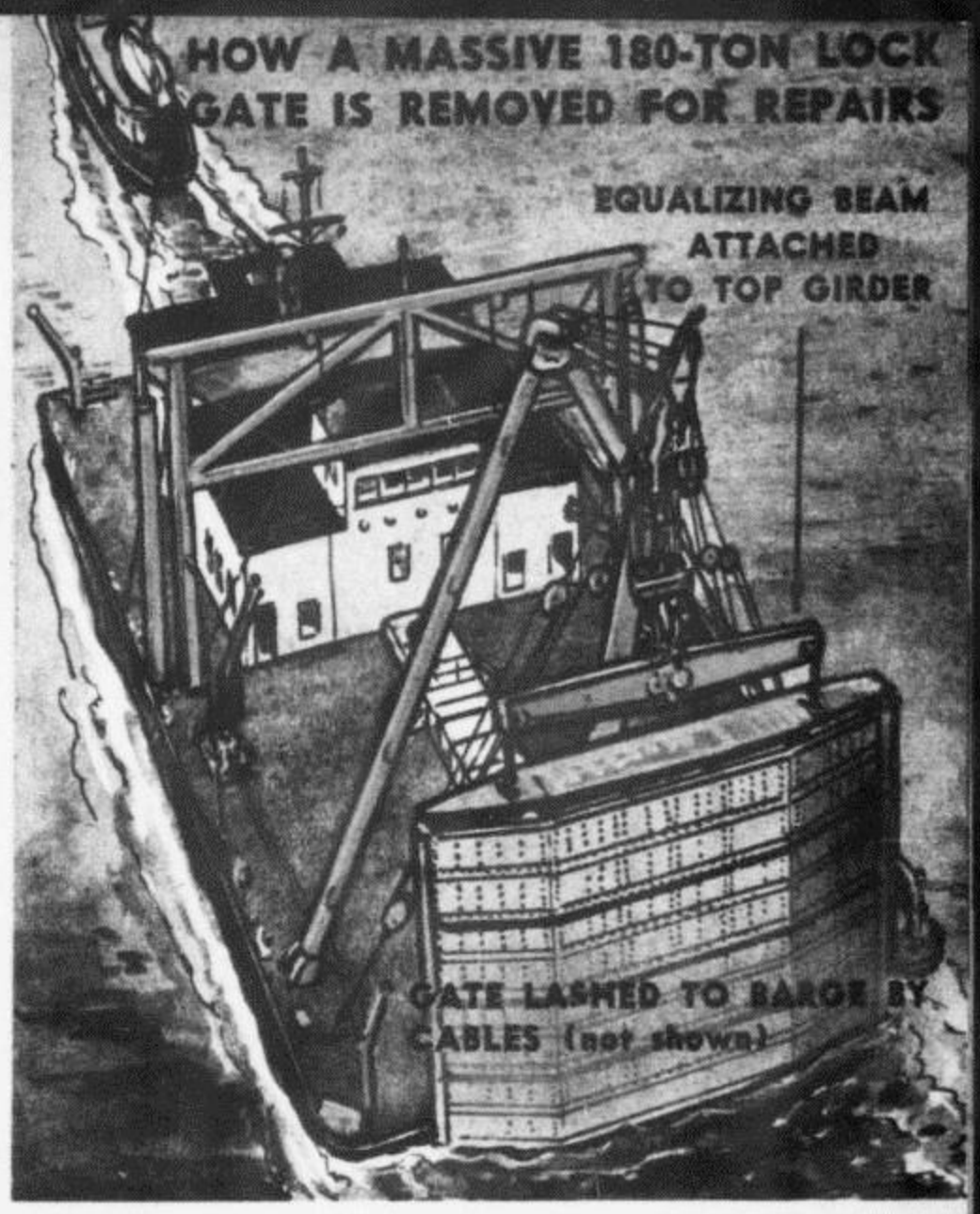
Engineers, eyeing the immense flow of essential war materiel through the St. Mary's Falls Canal, and fearing the bomb or collision that could block traffic, decided, in 1942, to add another lock. But where, they wondered, was the crane or floating derrick large enough to handle one of the massive lock gates? They began to sketch, draughtsmen labored over drawing tables, until at last Paul Bunyan, one of the world's greatest floating derricks, grew to manhood at Muskegon, Michigan.

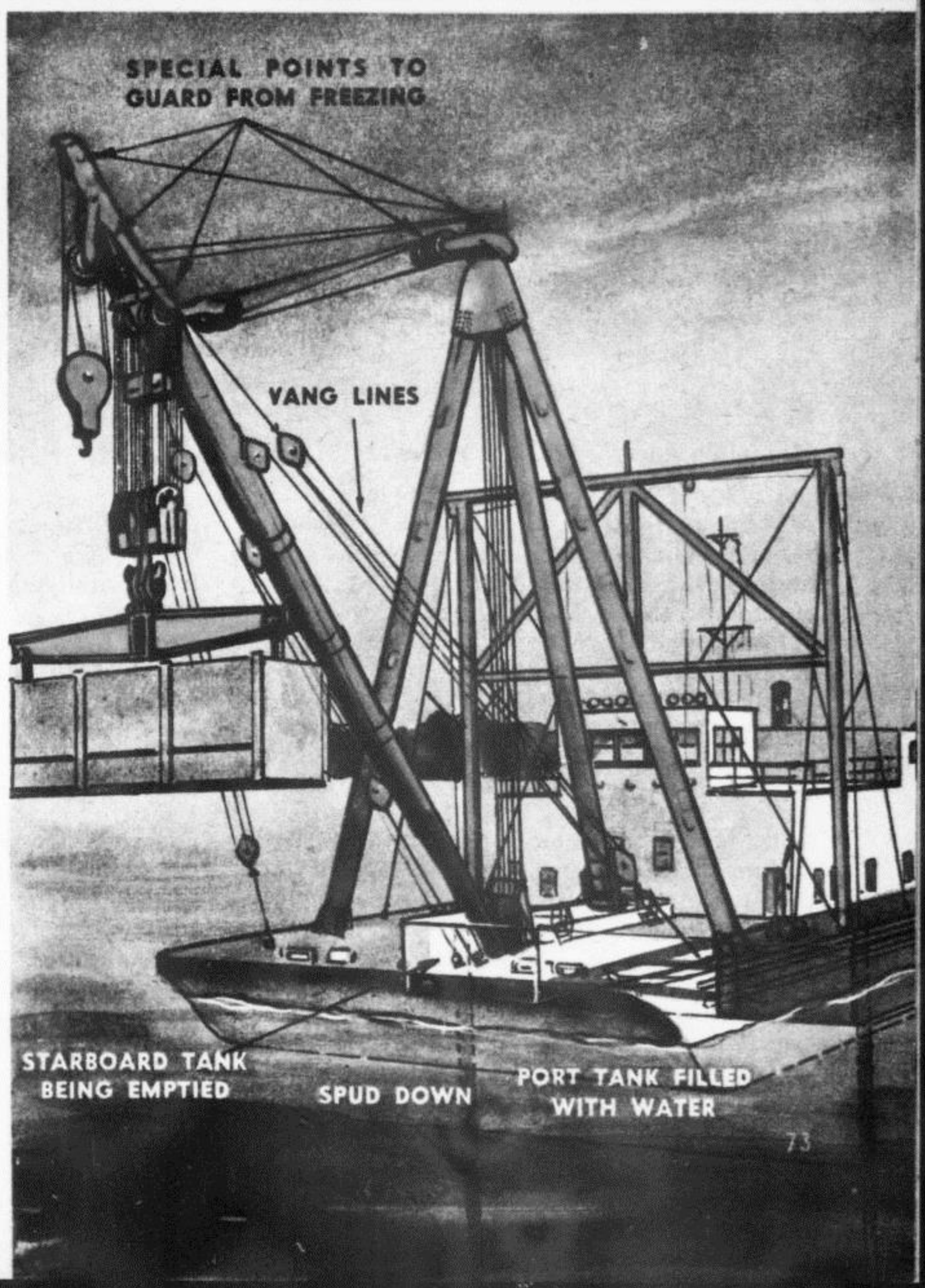
A lift of 250 tons at three feet a minute was specified. Did Paul do it? Look! They hooked on a test weight of 312 tons. Mr. Bunyan took one look at it, smiled, braced his 34-inch-thick legs, raised his powerful 42-inch arm, and swung the heavy mass into the air at the rate of seven feet per minute! At three-quarters throttle! And held it there all night!



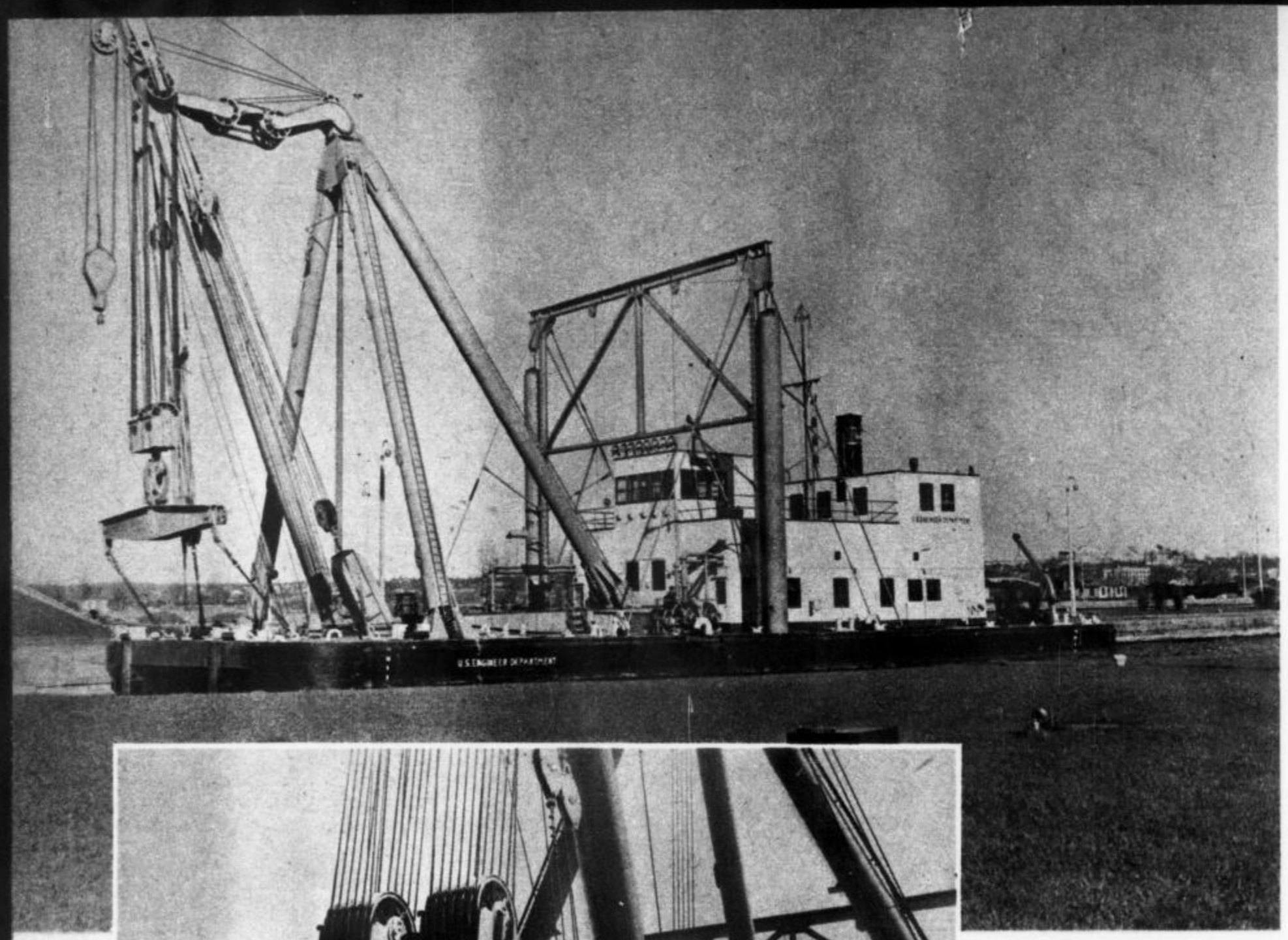
ELEVATION OF 300-TON DIESEL TUG BY MAIN HOIST

STARBOARD BUMPER AGAINST WHICH A LOCK GATE MAY SWING IN HANDLING





PRINCIPLE OF STABILIZING BARGE WITH THE BALLAST TANKS WHEN BOOM SWINGS WEIGHT OFF CENTER. HERE WEIGHT SWINGS TO STARBOARD AND WATER BALLAST IS PUMPED TO PORT SIDE



Submerged wreck? Here are the muscles to lift and move it away.

Closeup of load block. The giant hook and nut alone weigh 2½ tons.

Take a look at this fellow. Those sheaves in the load block are 48 inches in diameter. That tackle includes 24 parts of one and three-eighths-inch plow-steel flat-strand wire rope. Note the three sets of vang lines which steady and control the sweep of the great boom.

Paul's good on his feet—he won't capsize. He has six ballast tanks below the main deck, three on each side. The tanks on one side can transfer 400 tons of water to those on the other at the rate of 3,200 gallons per minute. This means that if the boom is hoisting a heavy tug or locomotive from one side, the tendency of the barge to dip on that side is easily neutralized by the shifting of water ballast.

It becomes bitterly cold up at the "Soo." Ordinary frozen mechanisms may falter, but not Paul Bunyan's. Hot steam circulates through his artery-pipes at critical places. Note another anatomical novelty, the "spuds" connected to the steel framework amidships. Functionally they are outriggers, legs which may be lowered to secure a firm grip on the floor of the canal or stream when a mighty heave is being made. Coordinated with the shifting of the water ballast they aid in maintaining the barge in a balanced horizontal position.

At the operating station are located the controls. There is a panel on which lights register the lateral traverse of the boom. There, too, are the levers for actuating the movement of the spuds. Gauges show the amount of water in respective tanks and valves permit the distribution of this water as required. Guided radio permits communication with the deck and engine room.

Paul "Derrick" Bunyan's quite a guy.

The Flying Flapjack

BY GILBERT PAUST

Photos by Rudy Arnold

It looks like an aviator's nightmare, but this Navy job is the fastest - and slowest - plane in the air.

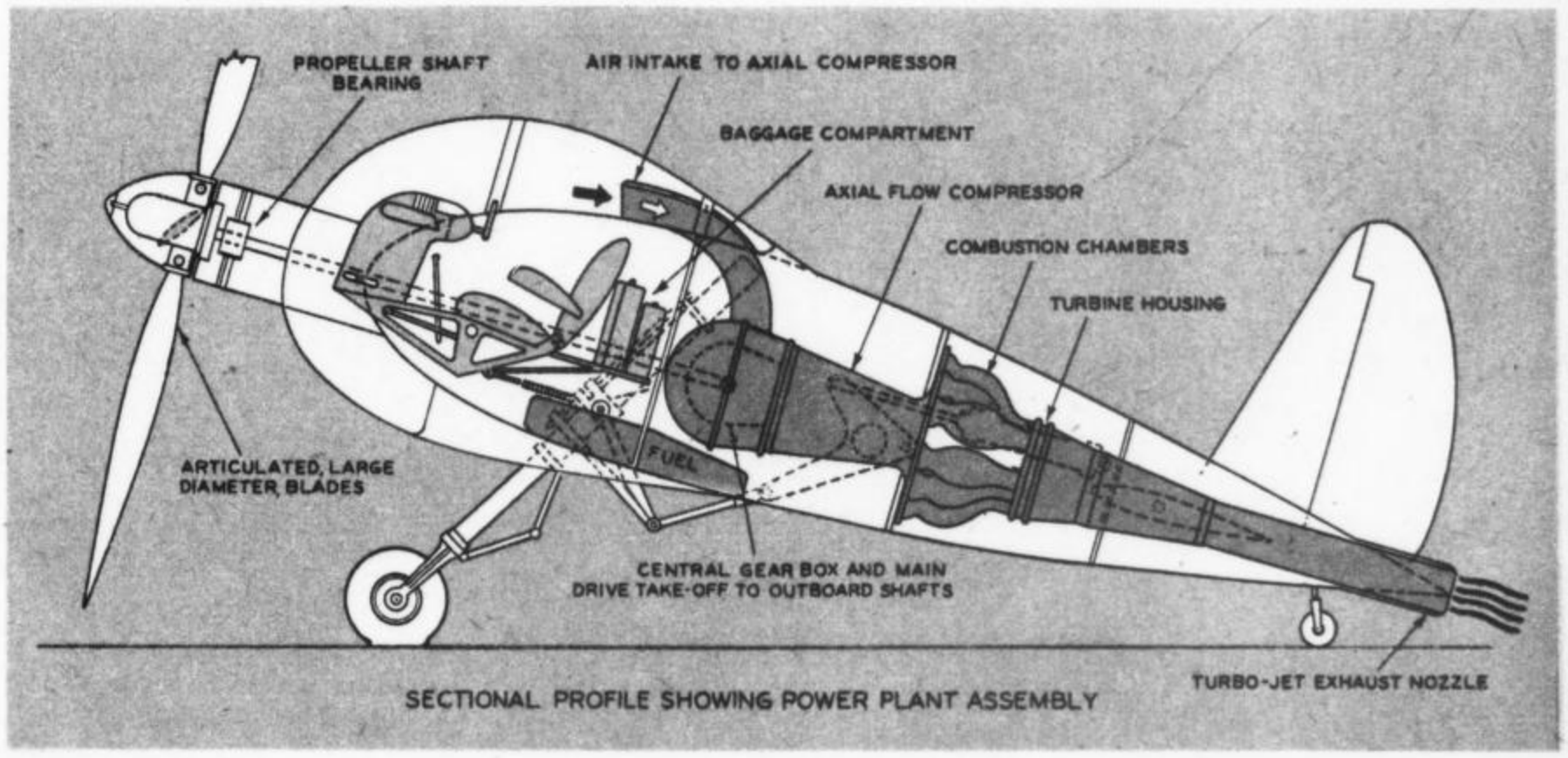
THE Navy has a flying Flapjack, and brother—it can fly!

It all began on a day in November, 1942, when the doors of the Vought hangar opened and test engineers trundled out a queer, saucer-shaped object on two long, stilted legs—and claimed it was an airplane. The V-173, they called it, and gave credit for its design to an aeronautical engineer who had been active in NACA research and had recently joined the staff of Chance Vought: Charles H. Zimmerman.

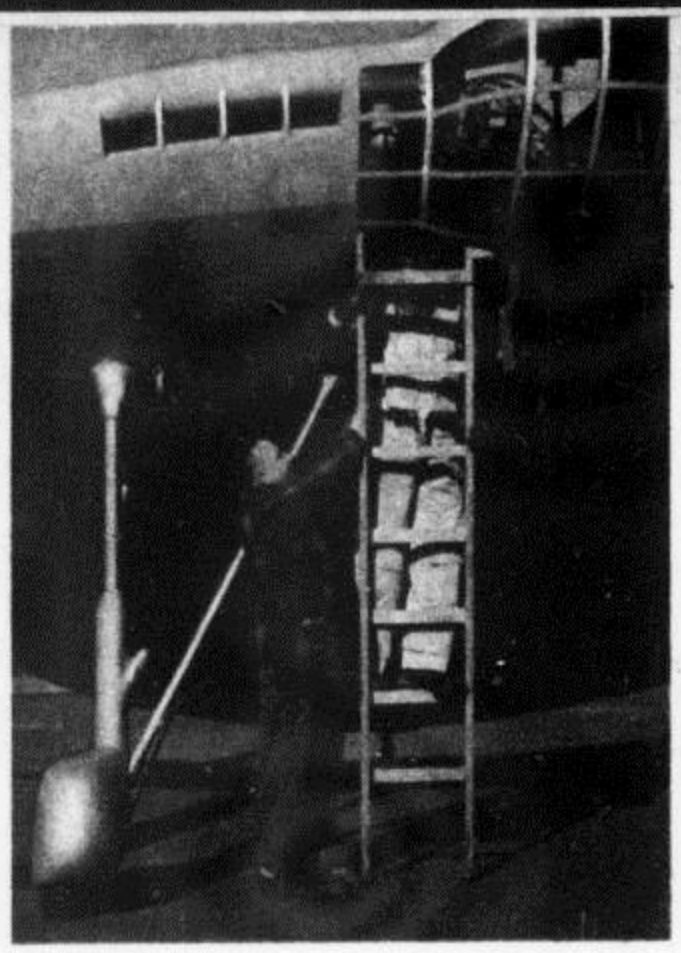
The test pilot, Boone Guyton, climbed the ladder that led to the small door under the nose, and entered the pilot's nacelle. The two huge, three-bladed propellers, protruding from the sides and looking more like helicopter rotors mounted vertically than conventional "props," started turning. With its nose pointing into the sky at a steep angle, the Flapjack flew.

Not much has been told about that first flight. The plane's first performance did not cause a great sensation among the

Tomorrow's Flapjack will be equipped with a gas turbine and jet assist, making higher speeds possible.



SECTIONAL PROFILE SHOWING POWER PLANT ASSEMBLY



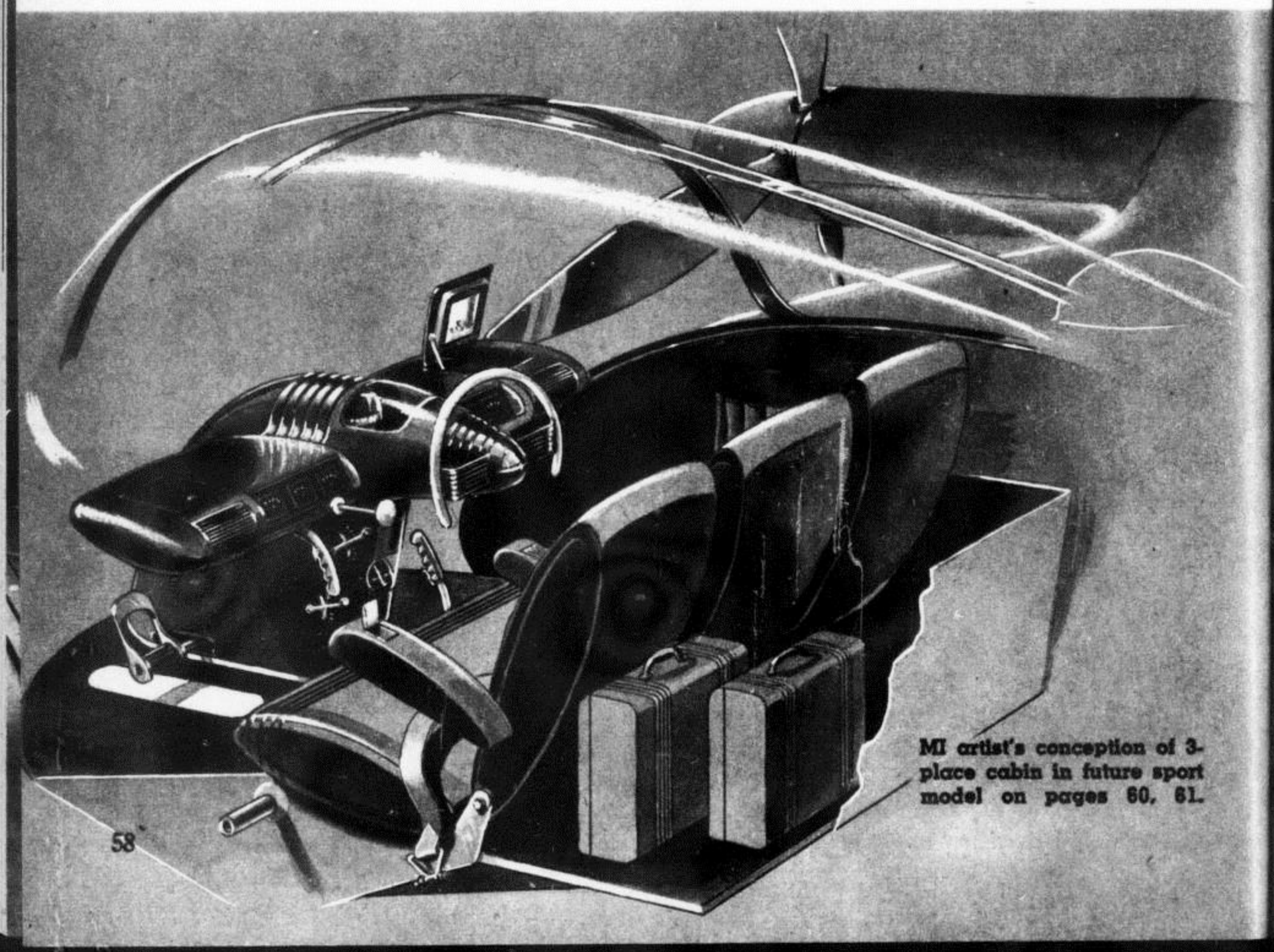
The V-173 is entered through a hatch below the pilot's cabin. Excellent visibility is provided through nose.

The XF5U-1 has retractable gear and is powered by two 1800-hp. engines. It is metal covered and uses four-bladed propellers, although its plan-form is the V-173.

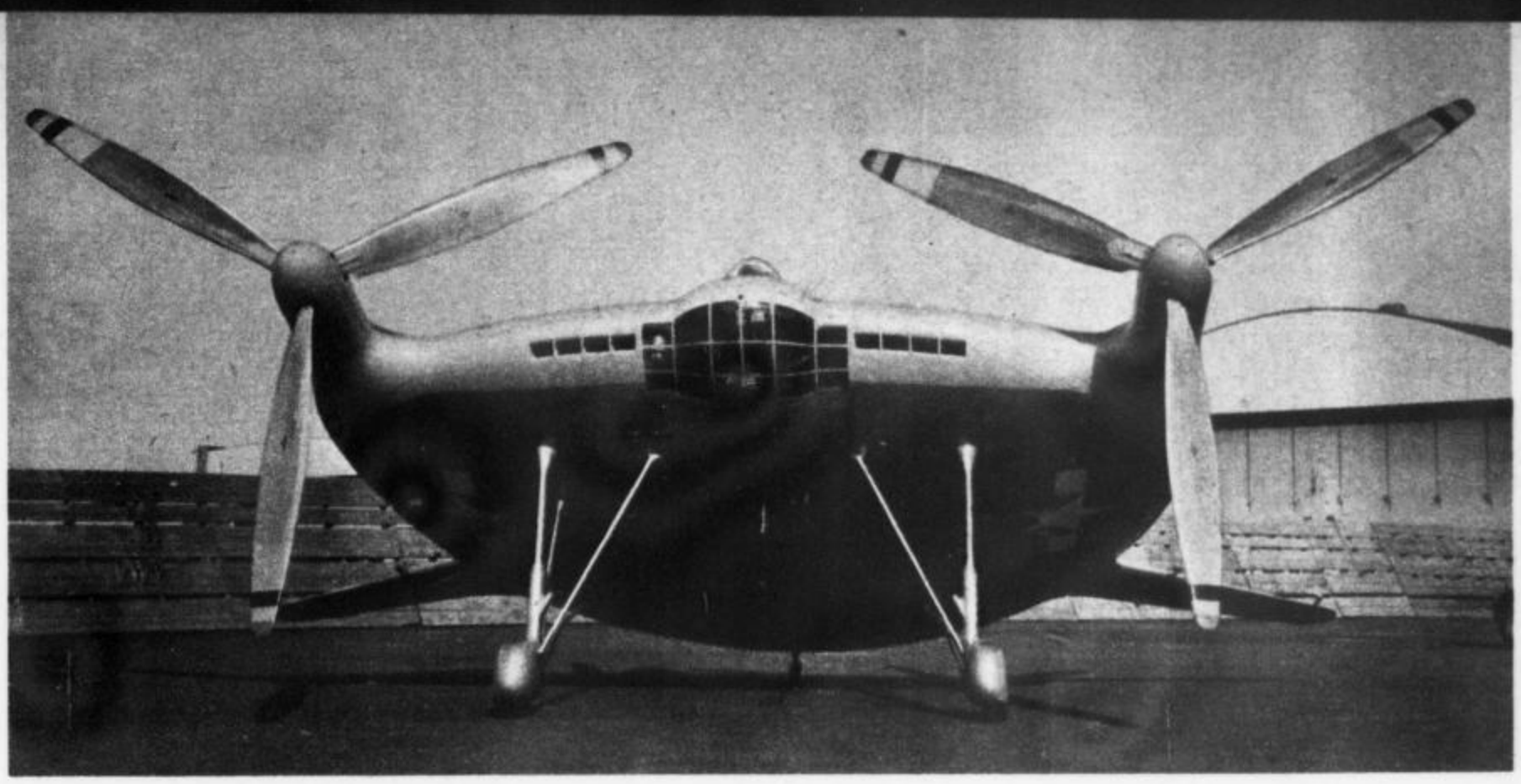
press at that time. The world was at war and there were many more important events happening in the skies to take the headlines. This new "crate" was just a bad dream, too radical a departure in aircraft design to be taken seriously. Even military censorship didn't know exactly how to handle it. Photographers shot some pictures; these were published and soon forgotten.

A couple of years later a new, slicked-up model was announced, bearing the Navy insignia and the designation XF5U-1. Nothing much was said about it. No mention of a test-flight was made. A couple of "hangar" pictures found their way into the newspapers and then the Flapjack faded from view, quickly smothered by warfront news.

The Flapjack wasn't scrapped; *it is po-*



MI artist's conception of 3-place cabin in future sport model on pages 60, 61.



High landing gear are necessary to hold propellers clear of ground. Airflow covers wing and tips.

tentially the world's most versatile airplane. All attempts to obtain information from its manufacturer and the Navy on its present status and performance have met with blunt refusals. The following facts have been gathered for you from reliable sources. Read them over and take your hat off to the slickest thing in the air!

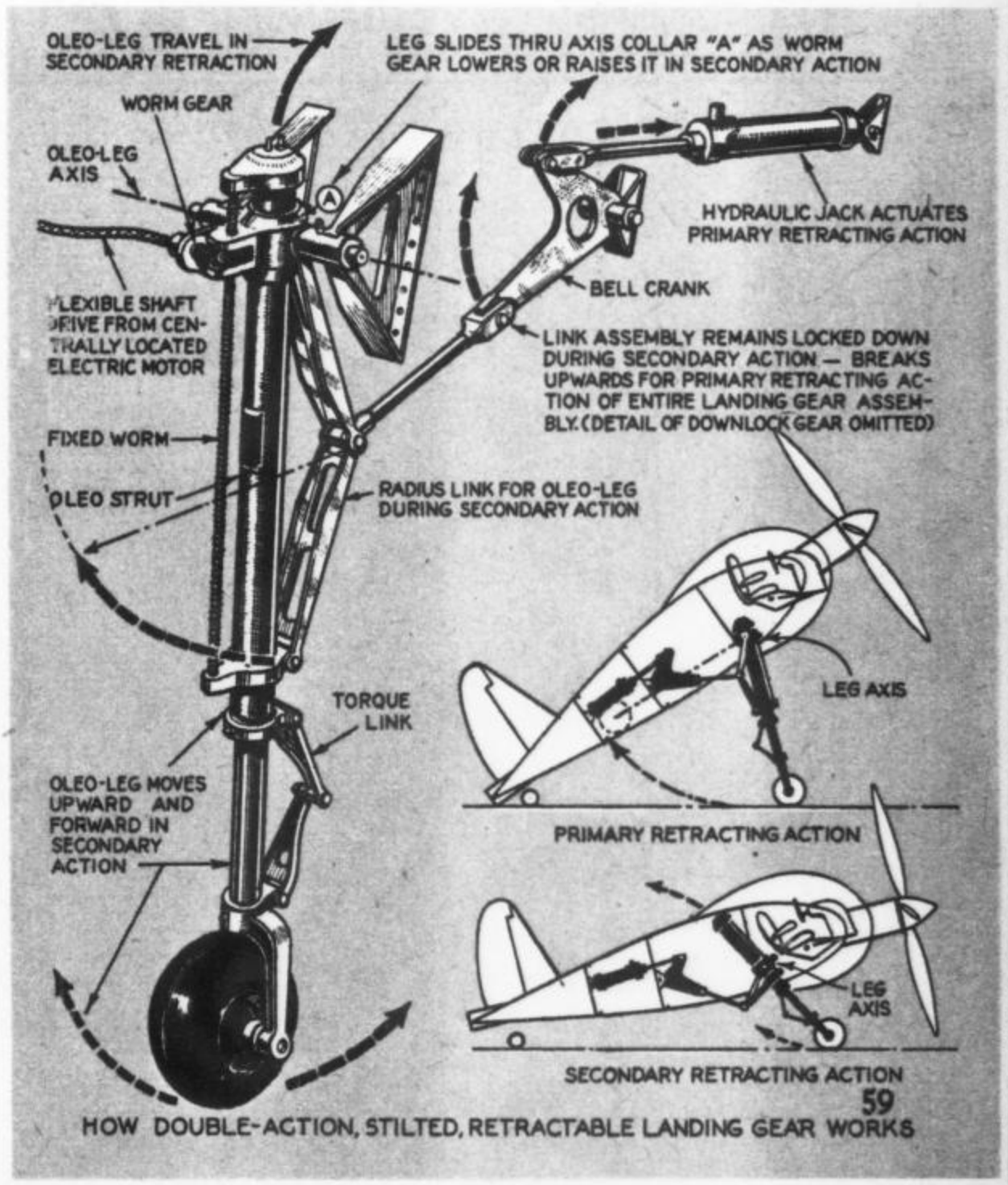
The basic wing plan of the plane is a circle designed as an airfoil to obtain lift from the air, at the same time serving as fuselage to house the pilot and engines. The large propellers are tractors, driven by fuselage engines with which they are connected by a gear-and-shaft arrangement. They turn at approximately ⅕ the speed of the engines. The propeller shafts project forward from the sides of the wing, positioning the propellers so that their airflow is continuous over the wing.

A conventional wing "stalls" (loses lift) when the airflow over its surface, caused by the travel of the wing through the air, is broken (burbles) at slow speed. In the Flapjack, however, since the airflow over the wing is not caused by its motion but by the propellers, the airflow remains unbroken and lift is maintained even at slow speed. Although the actual aspect ratio of the wing (span divided by width) is less than one, the effective aspect ratio is approximately four since the propellers rotate against the wing tips, maintaining flow here also and increasing the effective span of the wing.

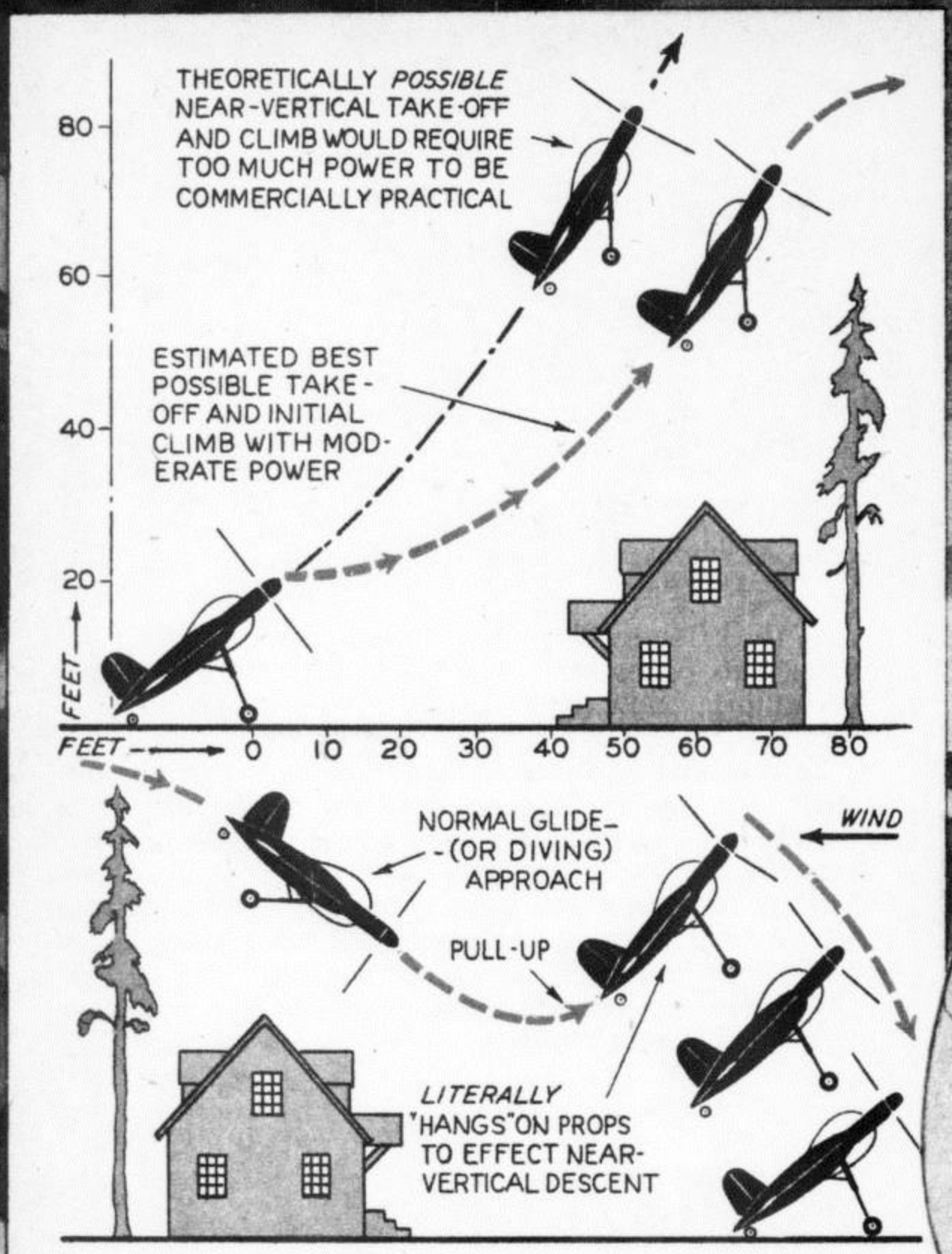
In a model utilizing a higher horsepower engine, such as a gas turbine, to turn the propellers, it is possible for the wing to point its nose straight upward into the sky and hover like a helicopter. Articulated blades, like those on a helicopter, maintain control for vertical ascent and descent. What a plane for a backyard airport!

The vertical control surfaces of the plane consist of twin fins and rudders, [*Continued on page* 79]

Drawings on next page



HOW DOUBLE-ACTION, STILTED, RETRACTABLE LANDING GEAR WORKS



TAKE-OFF AND LANDING POTENTIALS

UNIVERSAL JOINT

GEAR BOX

COMMUNITY HANGAR

SEAT UNIT NORMAL

(DIFFERENTIAL ACTION PERMITS COMBINED FUNCTIONS—AILERON AND ELEVATOR)

DOUGLAS ROLFE

GAS TURBINE AIR INTAKE DUCTS

CABIN HEAT AIR INTAKE DUCT

SEAT UNIT TILTED FOR TAKE-OFF

CABIN VENTILATING AIR INTAKE DUCT

LANDING LIGHT

AILEVATOR

AXIAL FLOW GAS TURBINE

The slow-fast flight characteristics of the Flapjack make it an ideal design for a sportplane. With extending, retractable landing gear (as shown on previous page), this 3-place model, designed by an MI artist, could operate from small fields only slightly larger than an ordinary backyard. At right is the V-173 in flight.

REFERENCE
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OCTOBER

STILL 15¢

SUPERSONIC AIR FORCE BY MAJ. GEN. CURTIS LeMAY

SEE YOUR NERVES—*IN FULL COLOR*

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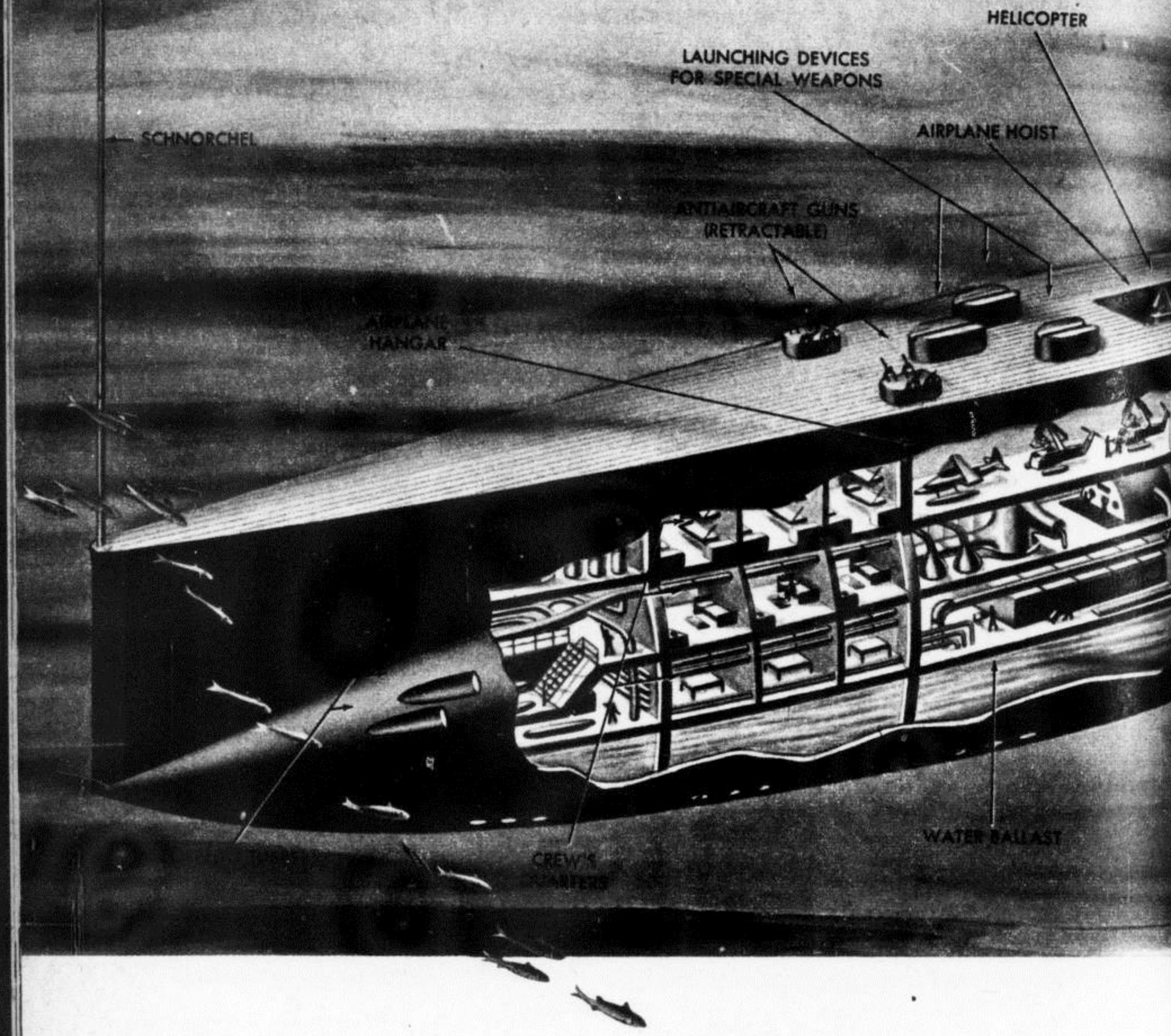
Atomic Sub vs. Atomic Bomb



IF THERE ever should be a "next" war, perhaps not a ripple will disturb the surface of the surrounding water as the zero hour approaches—but underneath, like a school of barracuda, a fleet of atom-powered submarines will streak toward their objective. Moving at possible submerged speeds of sixty or seventy miles an hour will be huge troop carriers, aircraft carriers, mobile weapon units, artillery carriers and even fully equipped hospital submarines.

This is quite possible. Although the atom bomb may not drive the surface craft from the seas it will probably result in the development of the submarine to a degree heretofore unimagined.

Of all the vessels comprising a modern navy, the submarine is least likely to be influenced in its design by the atomic bomb. At the same time, it is the type of vessel which is most likely to be influenced by atomic energy as a means of propulsion.

It is clear that the military minds of the United States are definitely interested in the application of atomic energy, not only to destructive explosions but also to the problem of "getting there fastest with the mostest."

Our subs will be atom-powered, and deadly with planes, guided missiles and atomic bombs.

BY WILLY LEY

When the Bikini tests have been fully evaluated we'll know more about their influence on naval design. But it would seem that of all the types of naval unit, the submarine is least vulnerable to atomic bombs. This is so because in order to hit a target you must "see" it, by actual vision or by radar. The submarine, with its ability to steal along under the surface of the water, is much harder to pick up, even with scouting aircraft, radar or sound detectors.

The submarine, as a war device, has the very powerful element of surprise. A convoy sails serenely along, guarded by its naval escort. Everything seems secure, when suddenly torpedoes explode, blowing transports and merchant ships sky high. The very shock of sudden attack has a demoralizing effect.

The first under-water attack by submarine was made just about 170 years ago by Sgt. Ezra Lee in New York Harbor, off Governor's Island. The machine was propelled through the chilly waters of the harbor by the muscles of its one-man crew, the aforesaid Sgt. Lee. The only source of air was that contained within the body of the vessel, about enough to last for twenty minutes. You can under-

stand that the sergeant had to work fast!

Robert Fulton built a submarine, the *Nautilus,* and tried her out in the river Seine in France. His submersible was very much like the revolutionary sergeant's. So was the only Confederate submarine which saw action in the Civil War. In this, eight men cranked a drive shaft, for power. More advanced models built by Wilhelm Bauer—one the first Prussian, and the other the first Russian, submarine —were driven by treadmills.

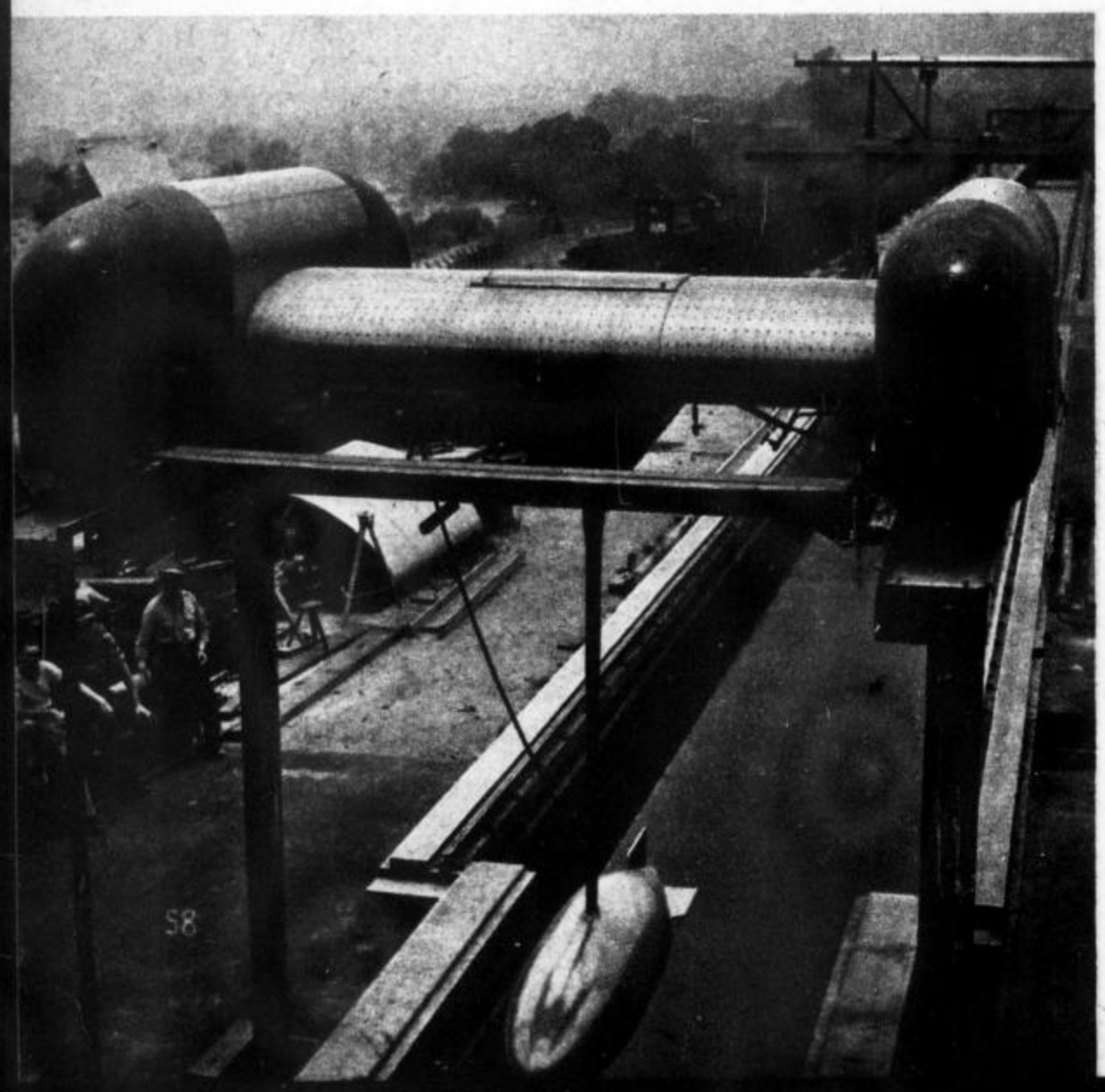
The modern submarine is only half a century old, being based on the *Holland.* Its inventor realized that muscle power was not enough. Other inventors had realized that, but they had not been able to find a suitable engine. Holland knew that there must be two engines—one each for propulsion on the surface and under water. For under-water travel only electric motors were feasible since they do not consume oxygen.

As the submarine grew in size the internal combustion engines made way for more powerful Diesels, but the two-engine system remained.

The displacement of the *Holland* was 74 tons, that of the German submarines of the first World War around 300 tons. The second World War brought out submarines of various sizes, depending on the type of operation for which they were designed: one of about 250 tons, another of about 1,500 tons, a third a little over 2,000 tons. For a long time the French *Surcouf,* built in 1929, was the largest submarine in existence. It displaced 2,880 tons at the surface, was 361 feet long, carried two 8-inch guns, two 37-mm. antiaircraft guns, several machine guns, ten torpedo tubes and a small seaplane. Late in the war the Japanese produced still bigger monsters with their I-400 class, displacing 4,660 tons, carrying three bombers and having a cruising range of 34,000 miles.

All through the war there were persistent rumors about a German submarine with Diesels which ran on hydrogen so that no batteries or electric motors for under-water cruising were needed. None of these rumors was true. What the Germans had developed was a device called the *Schnorchel,* a kind of breathing tube that permitted them to exchange their air and to re-charge their batteries while staying submerged at periscope depth. One of these boats is said to have stayed under for seventy days.

A composite picture of the most modern submarine that could be built today stacks up as follows: it could be of any size up to about 5,000 tons' displacement (of course nobody would want *only* large submarines). It could more than likely dive about 400 feet and if left undisturbed could stay submerged at such shallow

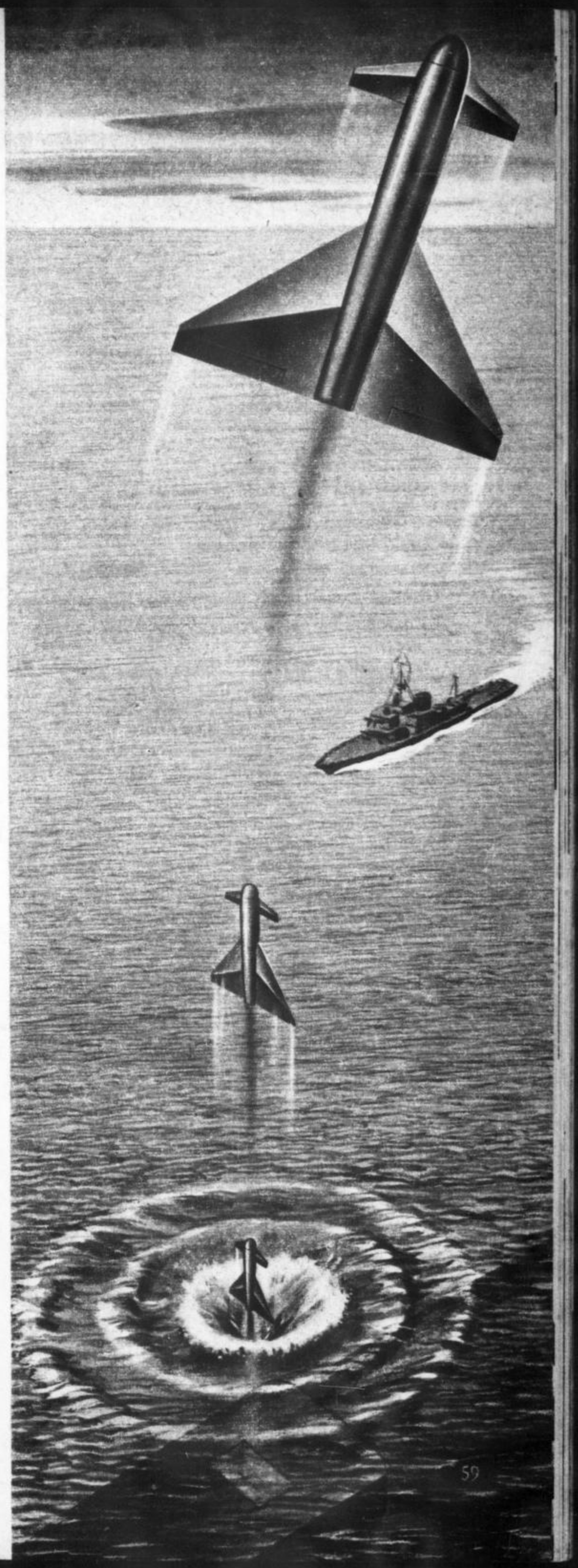


JET TORPEDO

THE hydrobomb, a torpedo to be launched from a fast bombing plane and jet-propelled under water at high speed, is undergoing simulated launching tests at the Jet Propulsion Laboratory of the California Institute of Technology (see photo, left).

It is about 10 feet long and 28 inches in diameter. It is designed to travel under water at 70 mph, driven by a solid-propellant rocket unit delivering 2,200-pound thrust for 30 seconds.

Mechanix Illustrated



Launched under the surface, guided missiles will unerringly find their targets.

depth for about three months by means of its breathing tube.

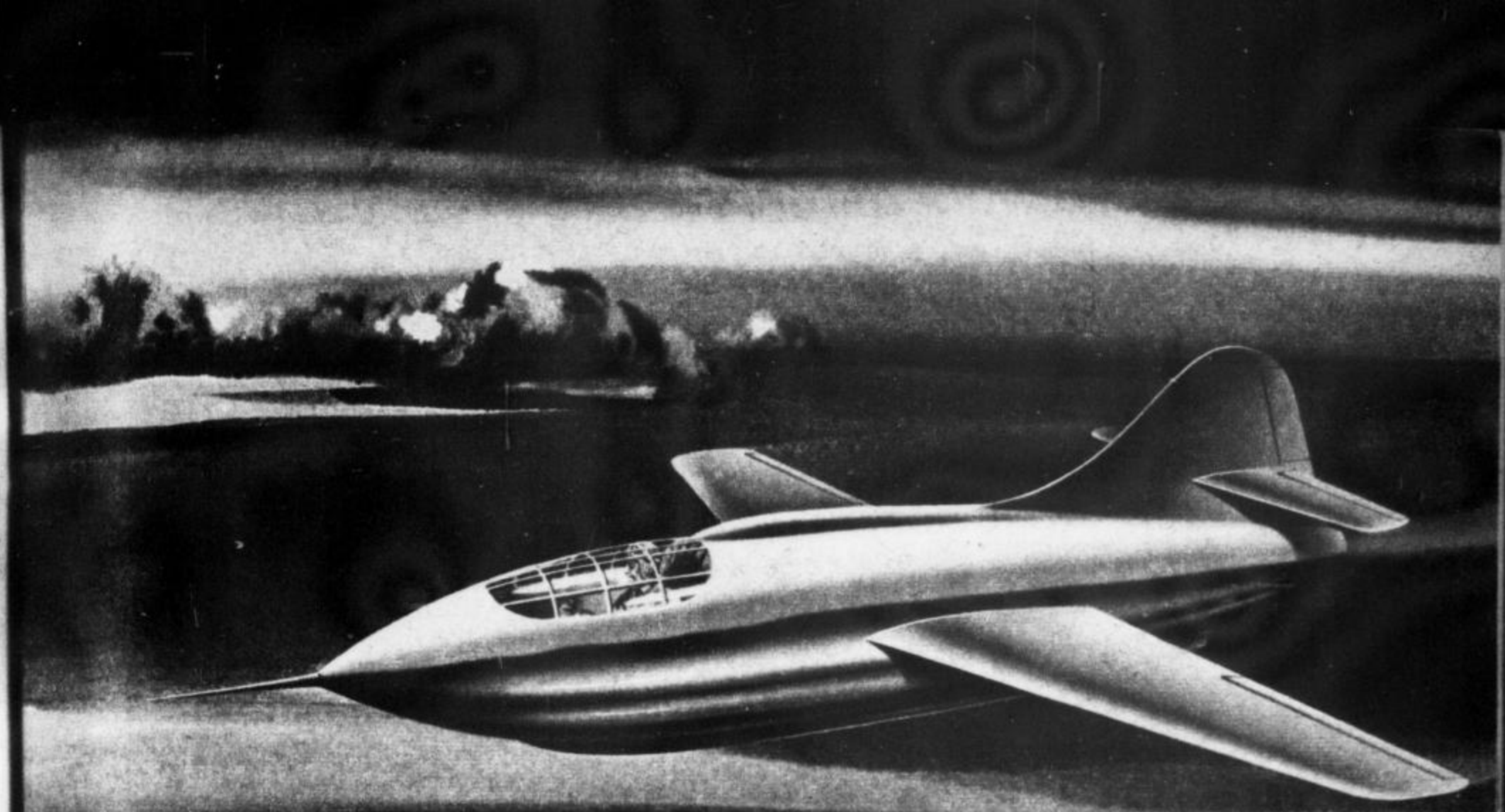
Its armament could consist of some 12 torpedo tubes and about eight 90-mm. dual-purpose guns as well as smaller weapons. And it could be fitted with a device for launching robot bombs of the V-1 type when on the surface. But it would have a large number of the usual weaknesses of all submarines. Physically, it could take less than half of the punishment that would cripple a destroyer. Only a little damage would force it to the surface. Its storage batteries would still have as much as one-sixth its total weight. And while its surface speed, powered by powerful Diesels, might be 22 knots, its cruising speed, submerged, could be only half that much.

As long as dual power plants are necessary to the submarine, no basic changes in design can take place. Basic change can be brought about only by an entirely new invention —and atomic energy looks like that new "invention."

It will not be necessary to use highly refined, almost pure U-235. Ordinary uranium, only slightly enriched with U-235, reacting in a pile, will suffice.

Naturally, plutonium would be produced in such a pile but this time the plutonium would be the by-product and the heat the main object. It has not been made known whether a pile can be operated at such a temperature that it produces high-temperature steam directly. If it can, the steam would drive the turbine of the submarine. If it can't, boiling water from the pile could be used to heat a liquid of a lower boiling point. Just what the details of steam production would be is up to the designers, but the pile looks promising.

Since no oxygen is used up, the operation of the uranium pile can go on [*Continued on page* 159]



Bell's XS-1

Can the supersonic XS-1 pass the mysterious barrier which bars flight beyond the speed of sound?

BY C. B. COLBY

FLYING today's experimental aircraft, according to Jack Woolams, Chief Test Pilot for Bell Aircraft Corp., is "like carrying a million dollars' worth of eggs down an icy street!"

He should know, for he is about to carry one of the most expensive eggs down aviation's iciest street—the street passing through the sonic range of high-speed flying.

To navigate this slippery road has long been the ambition and goal of aeronautical engineers and physicists. The most slippery spot is around 760 mph, the speed of sound at sea level. Once beyond that spot it is believed that there is almost no limit to what aircraft can do with sufficient power.

Aircraft runs into difficulty when the trans-sonic range is approached. Propeller-driven aircraft do not have the power required to push the airframes through the turbulence encountered when approaching this area of compressibility. Years ago a German ballistics expert named Mach (pronounced Mock) set up a system of speed measurements based upon the speed of sound, 760 mph, using that speed as "1." on his scale. Below that, speeds are indicated in decimals. For example, .5 is a speed of 380 mph while a speed of 2. is 1,520 mph. A speed of 1. is the critical spot that Jack hopes to negotiate with his "million dollar egg," the Bell XS-1 (XS for Supersonic).

Until this trans-sonic range in the speed scale has been passed, future aircraft design is stymied for lack of knowledge as to the sort of design required. In rockets and jets we have the power to pass this barrier, but heretofore we have not had the airframe.

We have the airframe now. The Bell XS-1, sonic research aircraft, is the key that Jack Woolams will use in an effort to unlock the door to all future high-speed flying. So far, our best speed has been 606 mph, or .85 Mach number. But, built on Army contract for the National Advisory Committee for Aeronautics, who did the wind-tunnel testing of the quarter-scale model at their Langley Field tun-

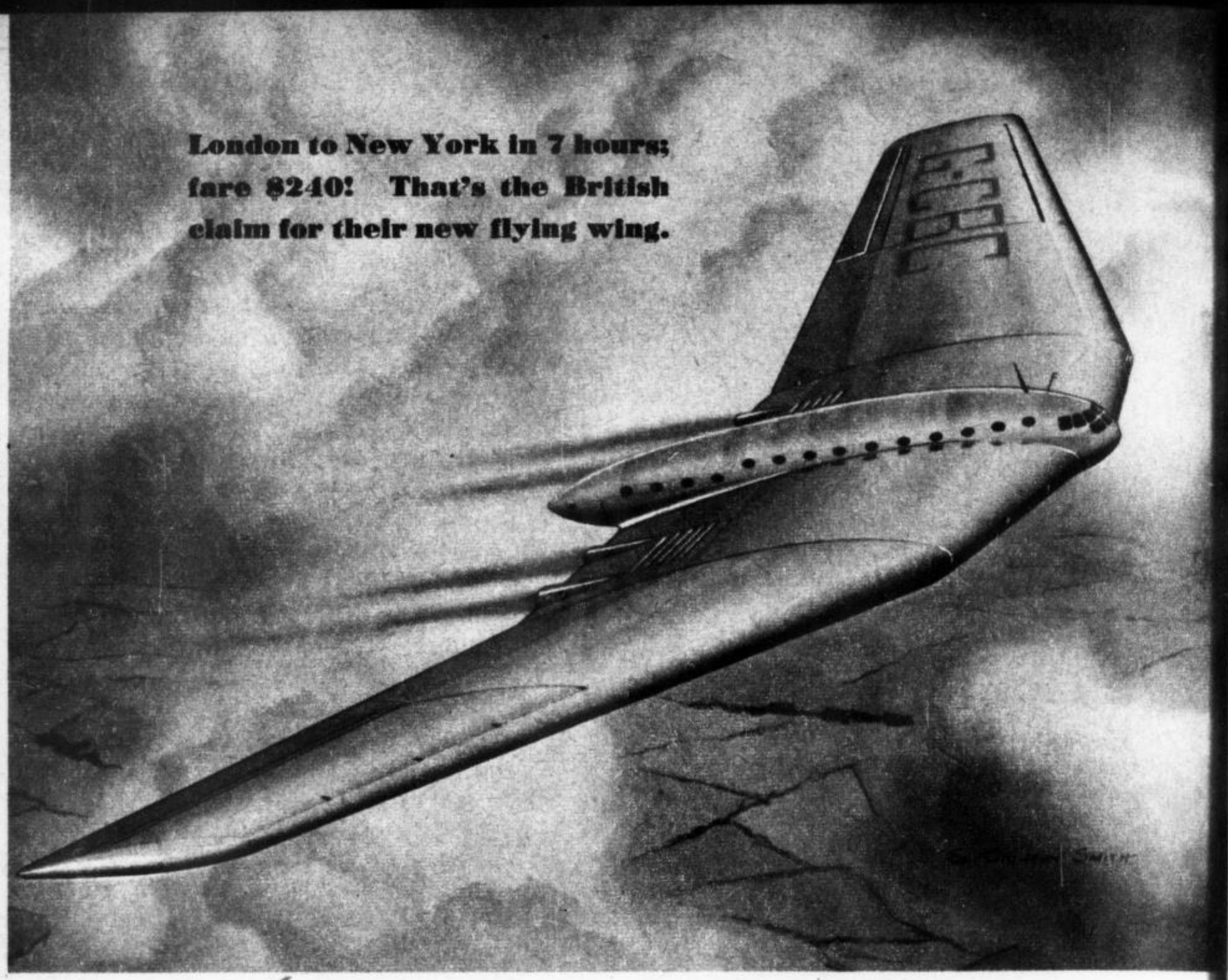
A B-29 carries the XS-1 aloft in its bomb bay and releases it slightly tail down. Right, the supersonic pilot, Jack Woolams.

nels, this aircraft, to use the words of Robert M. Stanley, Chief Engineer at Bell, is to see if "an orthodox aircraft with enough power" can break through the sonic wall at Mach 1.

The Bell XS-1 is an orthodox aircraft in that it has a standard airfoil, normal tail assembly, cockpit, tricycle landing gear and fuselage. Beyond this, in detail and power plant, it is unorthodox. Much has been written on what a supersonic (faster than the speed of sound) aircraft will look like, but it has all been based on theory and what the engineers *think*. The Bell XS-1 is based upon what the engineers *know*. Certain innovations have been included in the design of the XS-1, but they have mostly been necessary for the safety of the pilot and the return of the aircraft.

Inasmuch as the XS-1 is a research aircraft, its safe return is a must. Much of its flight data is transmitted via telemeters to engineers on the ground, for permanent records—but without the human pilot the test flights would produce little but limited mechanical information. High-speed, high-altitude rockets have been sent aloft many times, but until a human pilot rides a rocket through the stratosphere at a high Mach number we cannot know completely what goes on aboard the aircraft and in the human mind in this new realm of flight.

Looking at [*Continued on page* 79]

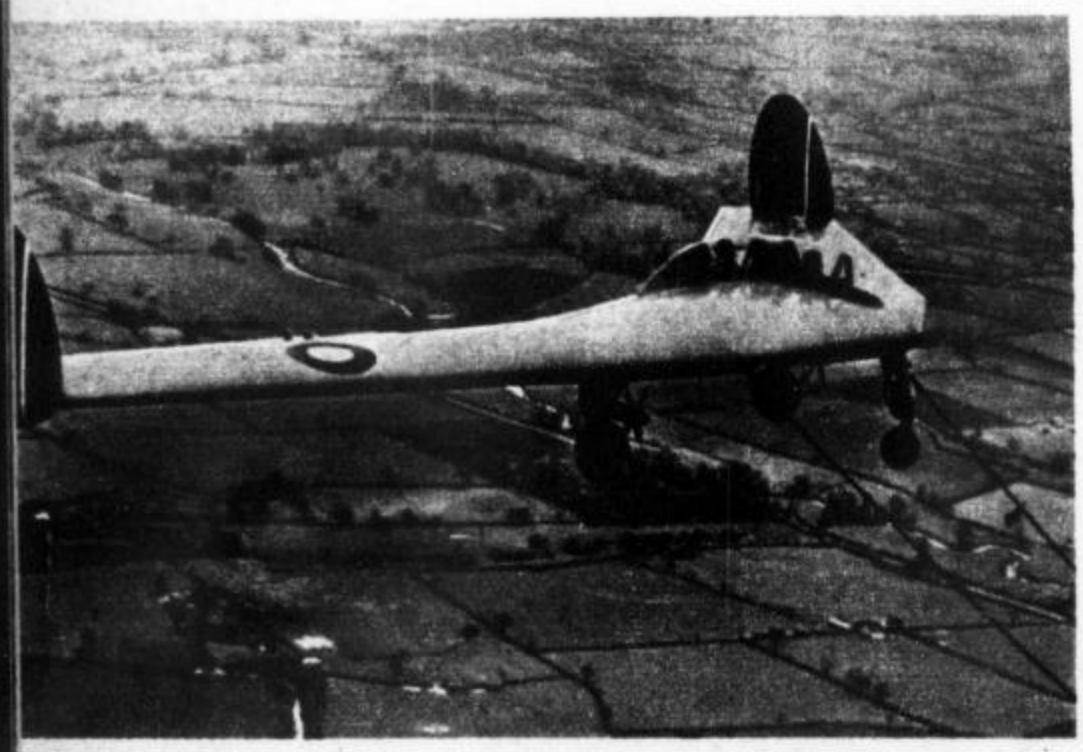


Lion grows a wing

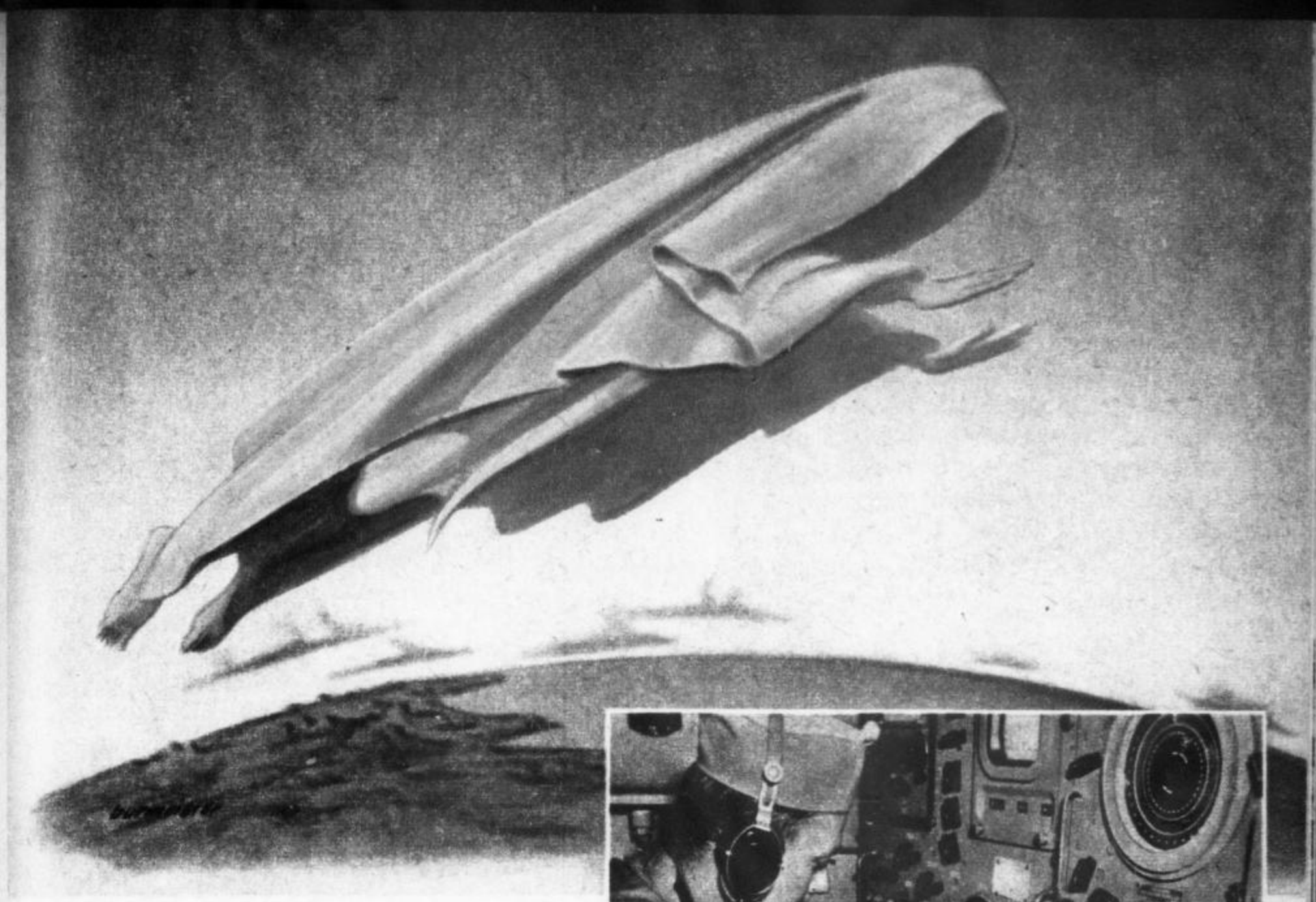
FOR some months a weird, soundless aircraft has swooped and glided over certain parts of England. This silent craft has been towed aloft behind powered aircraft and released at around 12,000 feet to soar and dart back to earth, these return trips sometimes lasting over half an hour. Upon landing, a ground crew has quickly pushed it within a hangar and hurriedly closed the doors behind it.

This unusual aircraft is a small scale, yet man-carrying model of the British Lion's bid for leadership in the flying wing race, now so conclusively held by the Northrop XB-35. With much "hush-hush" and secrecy the giant British wing has been slowly taking shape in the experimental hangars of Armstrong-Whitworth at Coventry.

Although stories of its being capable of carrying 50 passengers and crew from London to New York in seven or eight hours are not official, certain facts about the wing are more than [*Continued on page* 165]



This model glider was the guinea pig for the four-jet mother wing nearing completion.



Radar Spook

It's the riddle of the airways—radar doesn't lie but it detects something that just isn't there.

SPOOKS ride the airways!

Throughout the war, radar men were plagued by what they came to call the radar "spook." Echoes bounced back when there was no discernible object to bounce from and it was a common occurrence to track one of these invisible somethings for five or ten minutes, until it suddenly "vanished," then immediately pick up another to windward or overhead.

The mystery is still unsolved. Only speculative explanations have been offered for the riddle. The best one—unless you go along with the ghost theory—is that the spooks are isolated masses of water vapor. This has been thought most probable by Millard W. Baldwin, Jr., of the Bell Telephone Laboratories; but he is not ready to accept any explanation as final until more data is obtained.

Radar spooks usually move downwind at slightly more than prevailing wind velocity. In one sense they are earthy. They're seldom found at altitudes over 7,000 feet. Although birds have been known to cause radar echoes, Mr. Baldwin does not believe them responsible.

Superstitious folk claim the "things" were spirits of departing heroes, but science says it's just a catchy problem not yet ironed out.

Radar spooks did not prevent radar from becoming highly successful during the war, however. The United States Navy's amphibious flagships, equipped with the latest in radar, were the nerve centers for many vital Allied invasions.

In the accompanying photograph a skilled Army radar operator on the U.S.S. Ancon, from which the invasions of Sicily and Normandy were directed, scans the surrounding area to see that all's well.

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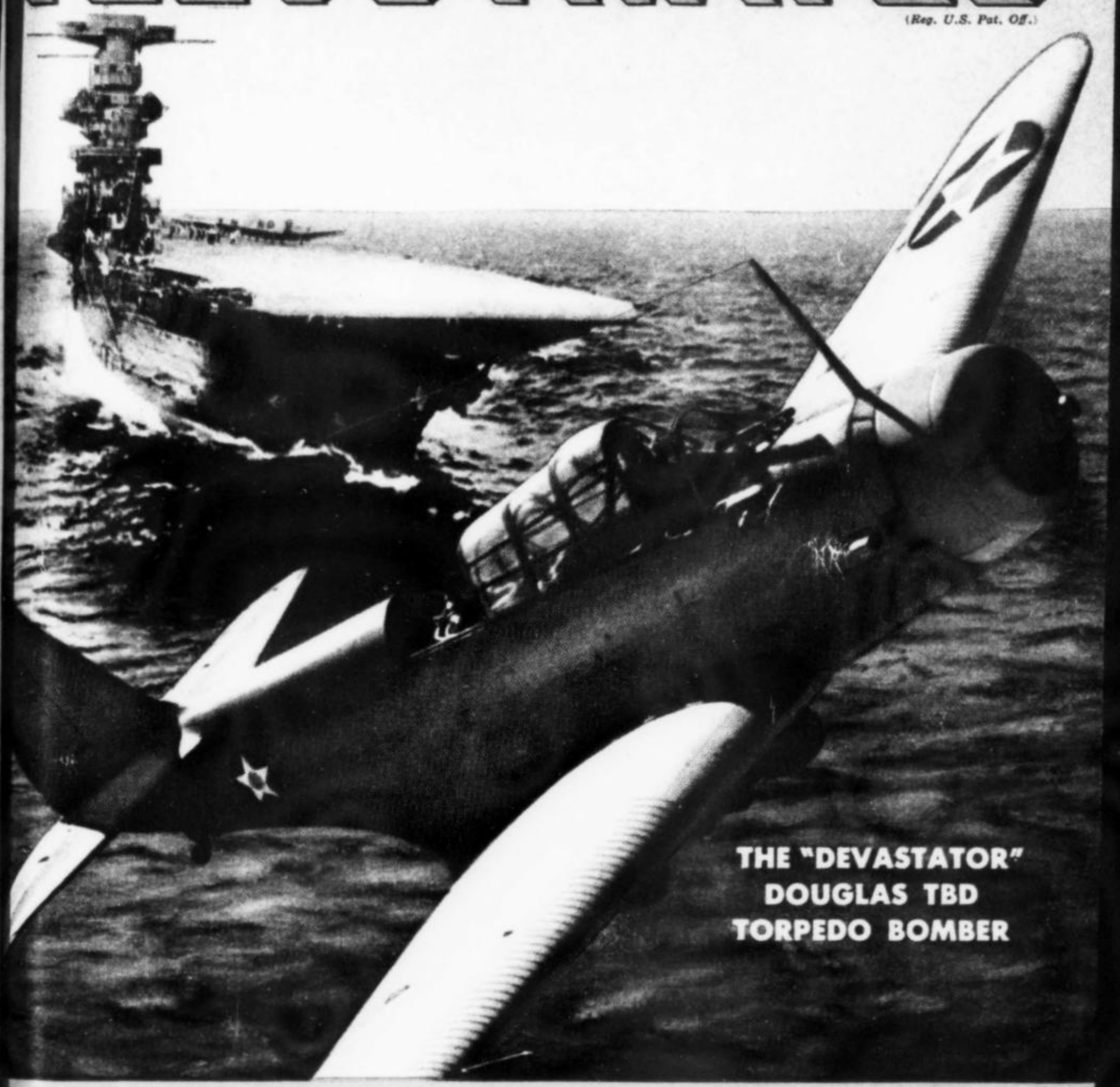

THE "DEVASTATOR"
DOUGLAS TBD
TORPEDO BOMBER

NEW AIR-BORNE TANKS TO SMASH AXIS

• SEE PAGE 40

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JUNE
1942

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Number 2

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WILLY LEY

Even to scientists, the tatzelwurm, gierfugl, hoatzin, okapi, and the quagga sounded like names dreamed up by a baby just learning to talk, until Willy Ley rescued them from neglect last year in *The Lungfish and the Unicorn,* his delightful and sound book (incidentally, his first in English) on the screwballs of the zoological world; in it he makes out a convincing scientific case for story-book beasts like dragons, basilisks, unicorns, and sea serpents. In contrast to that fanciful subject-matter, Mr. Ley in recent months has been writing on the grim topic of war weapons in a daily column for the newspaper PM. These articles and his best-selling book of last fall, *Bombs and Bombing,* have been so widely hailed as definitive discussions that MECHANIX ILLUSTRATED asked him to devise and describe the weapon which in his estimation could stop the tank terror. You'll find his feasible and encouraging suggestion for the United States on page 56 of this issue.

NEXT MONTH

Igor Sikorsky, one of the most famous names in aviation, tells you some startling things about that weirdest of all flying contraptions, the helicopter.

You'll learn about a mystery invention which may wipe out the torpedo menace, too.

And don't fail to read Flying Officer Jack Scherer's thrilling story, "Bombardier," written by a man on active duty in the R.C.A.F.

Be sure to get your July MI, on sale June 1.

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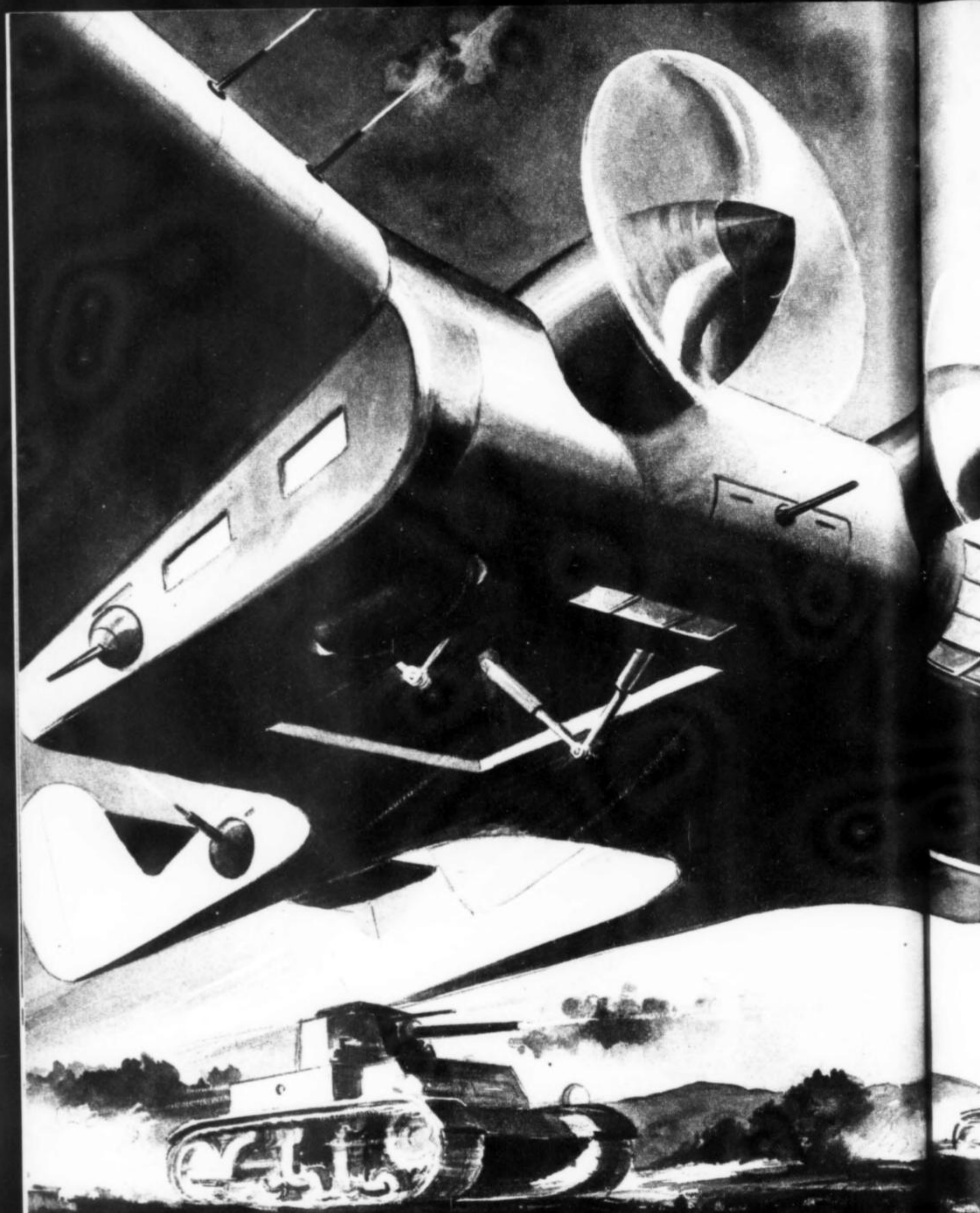


Burnelli Did It First

Mechanix Illustrated Drawings by Reynold C. Anderson

A HUGE transport plane snarls down on a battlefield. Panels in the great ship's belly open. Two tanks slide out of the belly, like retractable landing gears. The treads on the tanks start rolling—rolling up to a speed of 70 miles per hour. The great plane settles lower and uses the two tanks as a landing gear to touch the ground. As the tanks touch ground, a mechanism clicks and releases them from the plane. The tanks roar across the battlefield at 70 miles per hour, guns spitting. With a howl of acceleration, the great plane zooms upward again—to wing back to its base for more tanks.

A dream? A Jules Verne nightmare? Not at all. Such a plane is actually on a designing board at the present time!

And the airplane designer evolving this fantastic plane is, of course, Vincent Burnelli from America's Lone Star State of Texas.

We say "of course" because Vincent

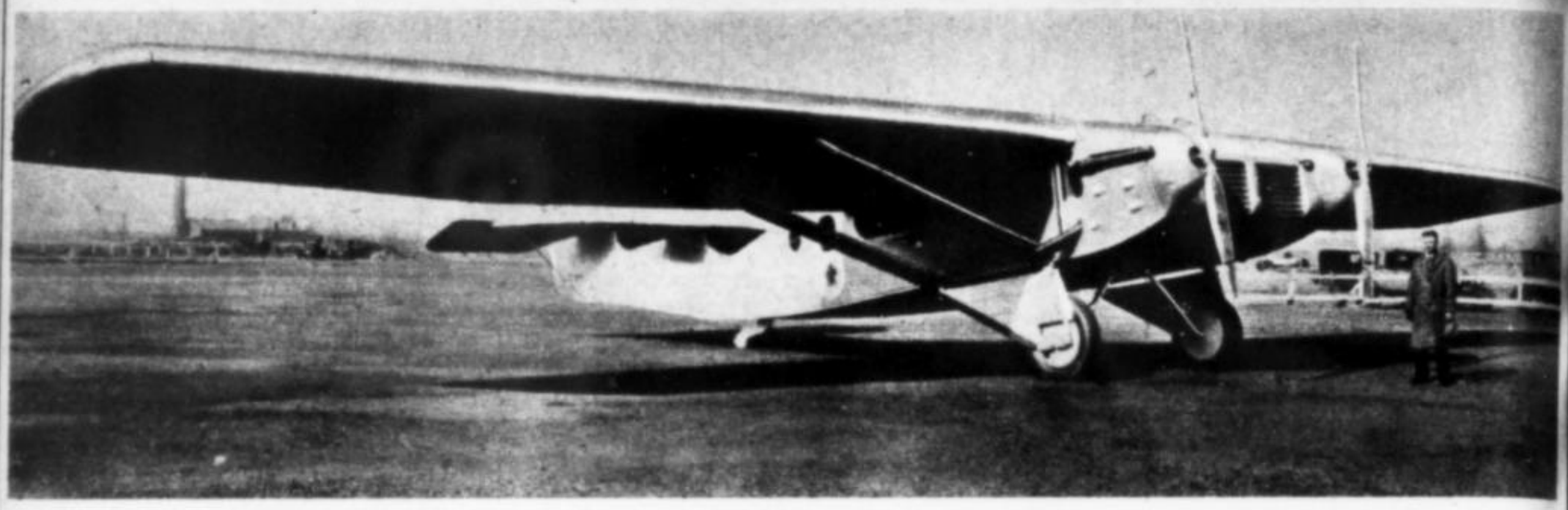
Artist's version of Burnelli flying tank carriers of the near future. When idea was made public in 1922, fliers scoffed.

A wizard of aviation actually designed, built, and flew the planes of tomorrow 20 years ago—and they hold the lead today!

George Daniels

Mechanix Illustrated

Aviation Editor



Another Burnelli first. This 1927 ship, the CB-16, was the first multi-engined airliner to use a retractable landing gear.

Burnelli is probably the only man in the world who has been visioning such a plane. For the name "Burnelli," although not widely known to the U. S. public, is synonymous with advanced all wing type airplane design, just as the name of Edison is synonymous with electric light. Over a period of nearly 30 years, Burnelli has been developing transport planes of far reaching possibilities and he has been consistently first in new developments.

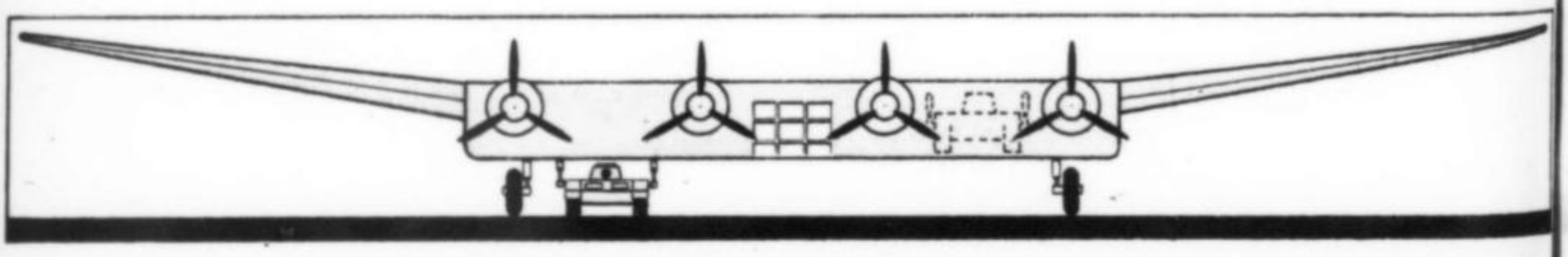
Actually, he has been working on tank-carrying planes since as far back as 1922. While we cannot tell you the details of his tank-carrying planes, other than from a patent drawing and our artist's conception of them, we can tell you about Burnelli, himself, and his impressive designs of the past.

Vincent J. Burnelli. His flying wings make aviation history.

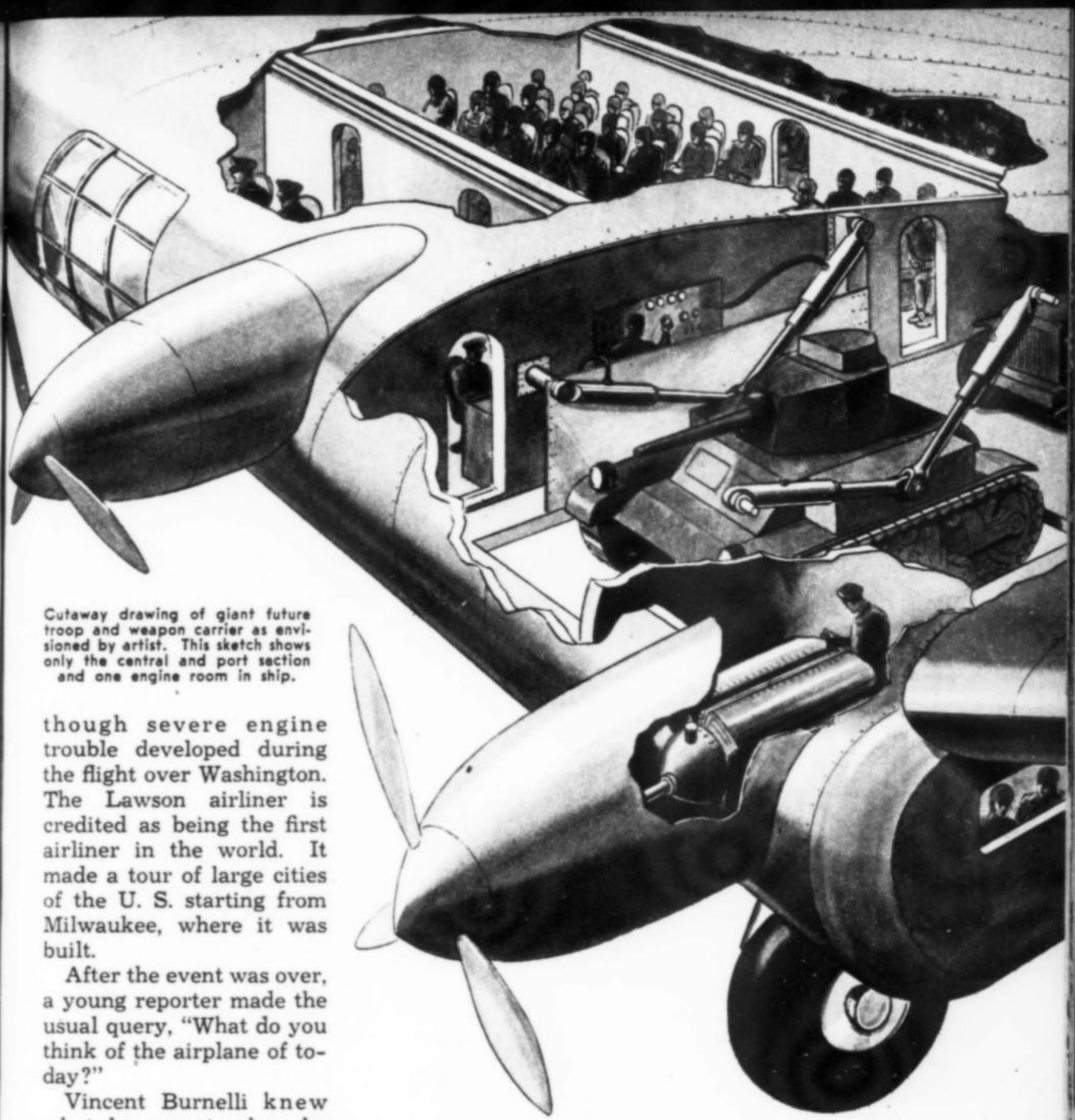
Designing an automobile showroom isn't an unusual feat when it's done in the ordinary way. The one that Vincent Burnelli designed was something different, however. It could fly. It actually did fly very nicely with the automobile right in it, along with all the salesmen, the furniture, desks, and incidental displays of various kinds of automotive accessories. But that's old stuff. Burnelli did that in 1925 when the Model T was still rolling off production lines. The flying showroom didn't carry a flivver though, it carried a full fledged Essex coach on its flight from city to city.

That was by no means the first achievement of designer and builder Burnelli. Unlike many figures in aviation, he wasn't born with a blazing, bombastic determination to make things fly. "I just happened to fit into it. . . ." he says. It all started when he was just a kid who'd learned engineering. He landed a job as draftsman in a Long Island coffin factory—converted to building Moisant airplanes. The name Moisant has more punch to it when you remember that John B. Moisant was the first man to fly around the Statue of Liberty in an airplane, and then land where he started—Belmont Park. N. Y. He won $10,000 doing it.

But Moisant's brother Alfred B., who operated the factory, had to lose his young draftsman because the young draftsman was destined to become the design and construction head of a half dozen aircraft companies in as many years. Without knowing it, he held the course of history in his hands when the great Lawson Airliner—his construction job—took off with an epoch-making load of important Washingtonians. Among the passengers was Senator Harding—later President, and 16 other U. S. Senators. Afterwards, the imposing list of politicos who rode in that ship provided the deciding votes that kept America out of the League of Nations. If that plane had crashed—well "Vince" Burnelli, as his friends call him, would have become of notable effect on history. But the ship didn't crash,



Artist's sketch of giant Burnelli tank and troop carrying plane. It taxies over tanks to pick them up. In air, wheels also retract.



Cutaway drawing of giant future troop and weapon carrier as envisioned by artist. This sketch shows only the central and port section and one engine room in ship.

though severe engine trouble developed during the flight over Washington. The Lawson airliner is credited as being the first airliner in the world. It made a tour of large cities of the U. S. starting from Milwaukee, where it was built.

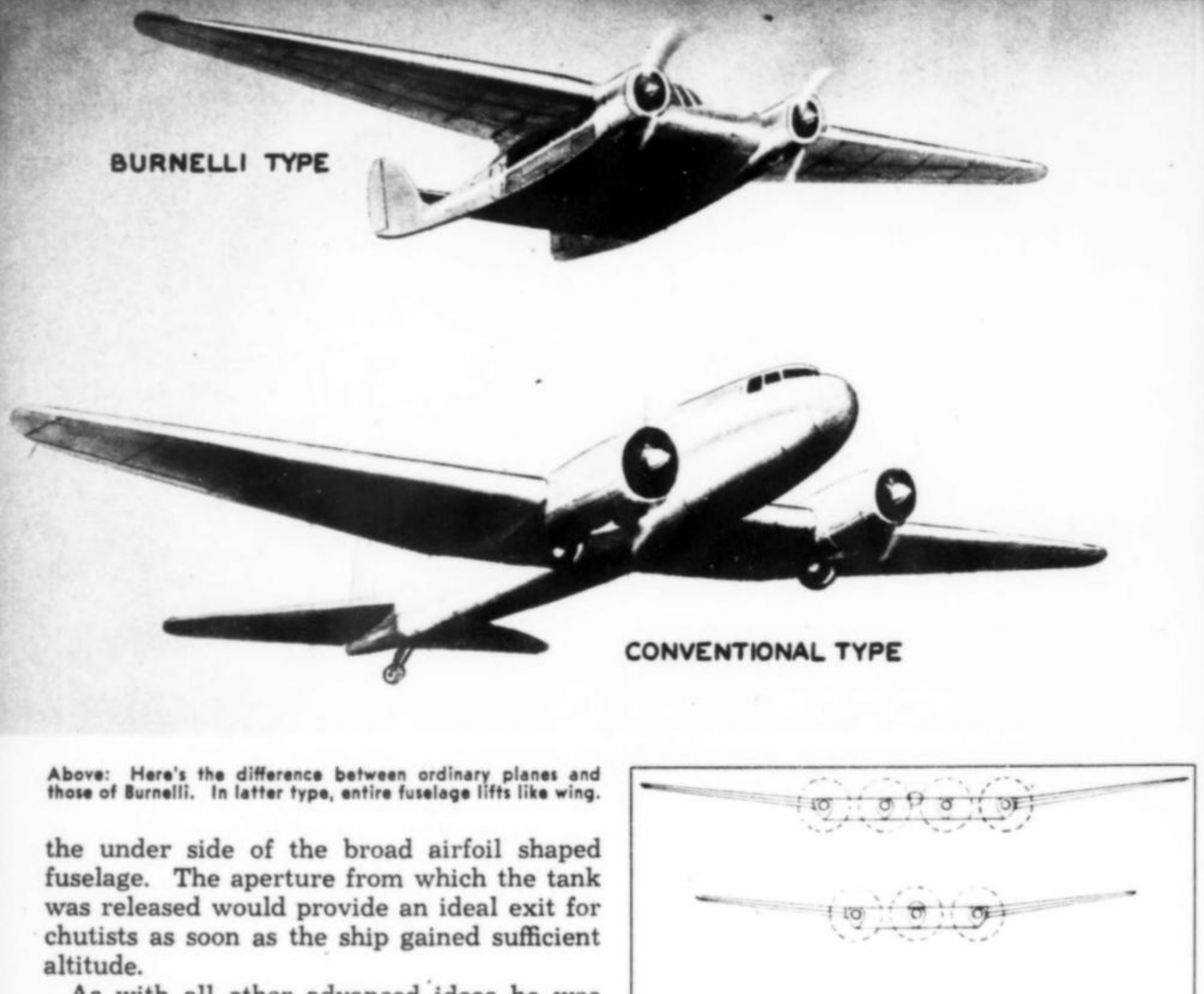
After the event was over, a young reporter made the usual query, "What do you think of the airplane of today?"

Vincent Burnelli knew what he meant when he smiled politely and said, "It's just being born."

He had an idea and he didn't give a tinker's dam for the fact that aviation bigwigs called it impossible. He wanted to develop a fuselage shaped like a wing so that the whole airplane would lift. One more conventional engineering job convinced him. The 30 passenger Remington-Burnelli Airliner was the result. Then, in 1921 the fun began.

Burnelli applied for a patent on the lifting fuselage and started building his fantastic ships. Unbelievable as it seems, the fuselage could lift as much weight into the air as the wings. Even though he had amassed bundles of theoretical proof in advance, when the first big ship actually went aloft and demonstrated the point, Burnelli was almost surprised.

It was in 1922 that he first thought of carrying war tanks in his planes. He had already built his airliners with the engines *inside*—in a forward engine room for easy attention in flight. Obviously, even with such tremendous weight carrying capacity as his ships had, it would be difficult for them to land and discharge the tanks in the type of country likely to be encountered in wartime. And yet the value of high speed delivery of these weapons was inestimable. Vince Burnelli was determined to find the answer, and he did. He designed a plane more startling than a fiction writer's dream. The patent drawings even showed especially made tanks suspended in

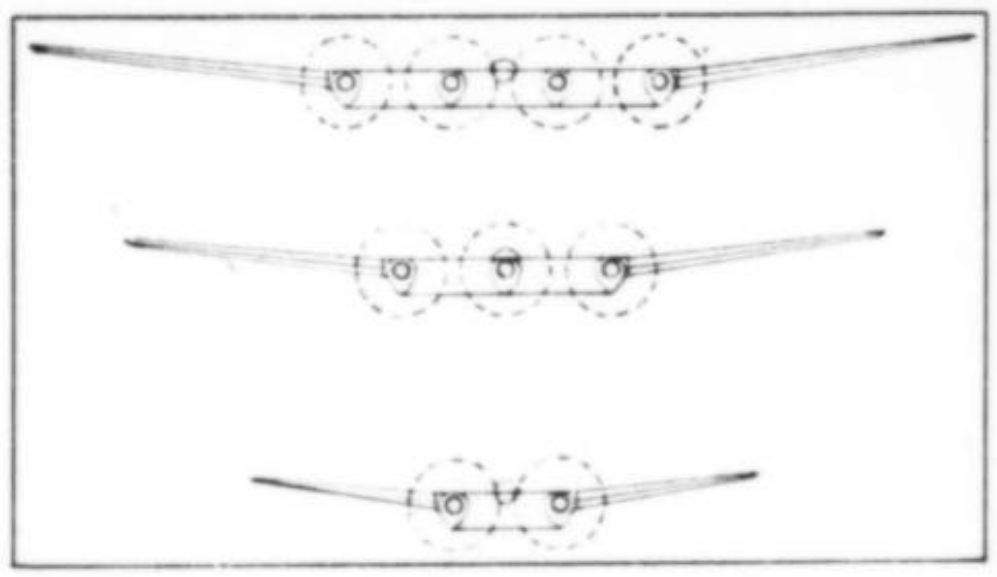


Above: Here's the difference between ordinary planes and those of Burnelli. In latter type, entire fuselage lifts like wing.

the under side of the broad airfoil shaped fuselage. The aperture from which the tank was released would provide an ideal exit for chutists as soon as the ship gained sufficient altitude.

As with all other advanced ideas he was told that it couldn't be done. That didn't bother him because he hadn't planned to do the job right away. "It takes about twenty years to fully develop a good idea," he said. And today in 1942, just twenty years later, he's ready to prove the point. Such great flying war monsters as visioned and now practical may easily add a new concept to modern warfare.

Rough wartime air bases hold no terrors for Vince Burnelli's huge wing-bodied air giants. Eight years ago when one of his experimental ships lost its ailerons at 250 miles an hour, due to a mechanic's assembly error, the plane struck the ground at more than 2 miles a minute. It had been flying only 50 feet off the ground in a speed test, and rather than risk flying without ailerons over the crowded city bordering the airport, the pilot chose to risk death in a deliberate high-speed crash. The ship plowed deep into the frozen ground but the pilot and engineer walked out of it afterwards for a smoke. Uninjured, pilot Lou Reichers pointed out to astonished "rescuers" that the cabin was absolutely intact, windows were whole, windshields hadn't cracked—in

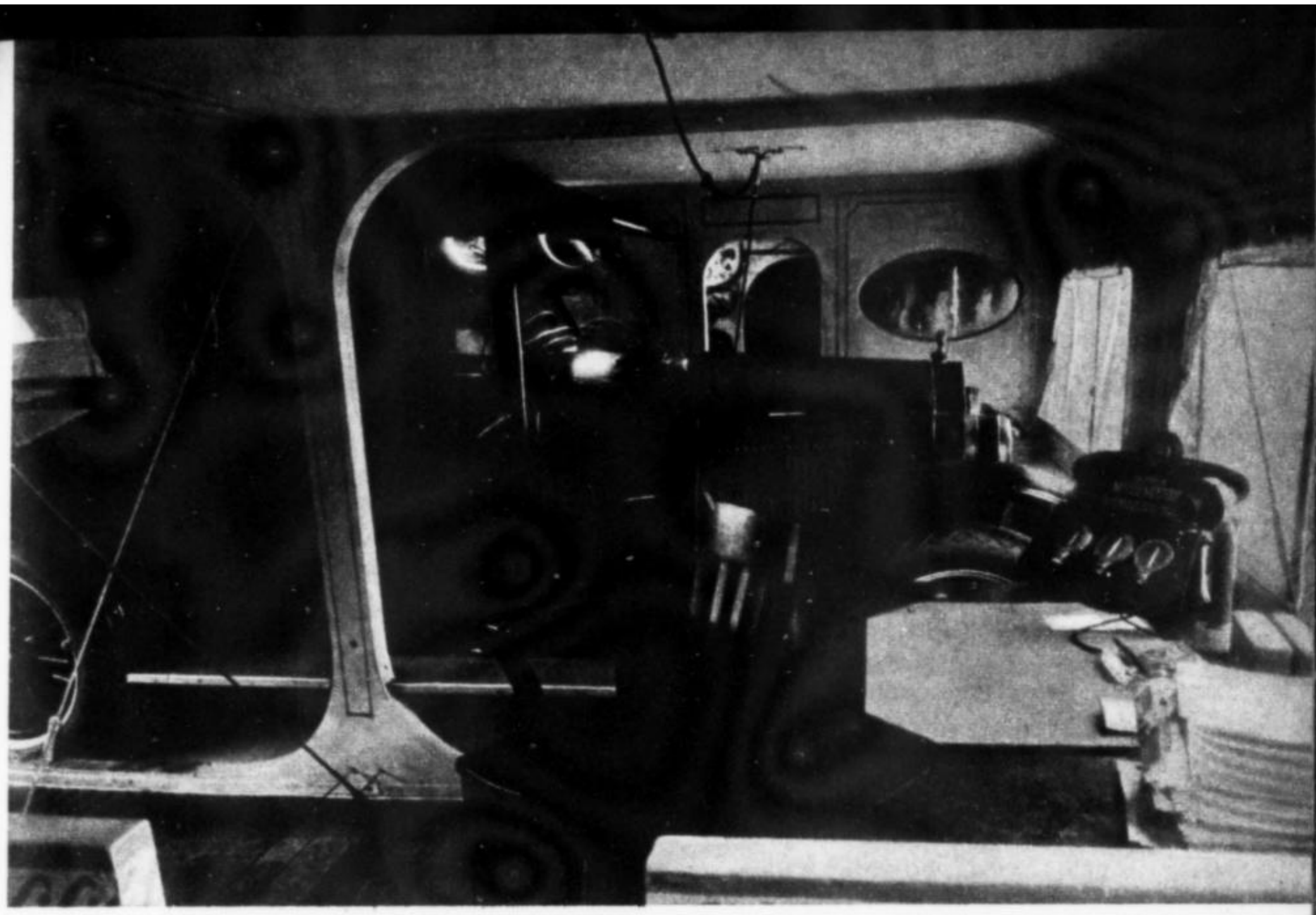


Burnelli plans to increase size of commercial transports and freighter planes merely by adding sections to broad wing-shaped fuselage as shown above. Each section added also adds a motor. The sections increase both lift and power.

fact even the gas tanks were in perfect shape and hadn't leaked a drop.

Clyde Pangborn, world famed long distance pilot, added an almost incredible accomplishment to those already on the list of these strange flat airliners last year. He provided a happy answer to the war fliers' old worrier—what to do when your controls are shot to pieces. The way Pangborn rigged up the Burnelli transport he was flying in war torn Britain, nothing important would happen if the controls *were* shot away. He added an auxiliary elevator panel and flap at the rear of the wing-like fuselage and demonstrated that he could control the ship in every longitudinal attitude, even landing, whether the tail surfaces were working or not!

Up to now all these bizarre ships have had only two engines, but a plan has already been

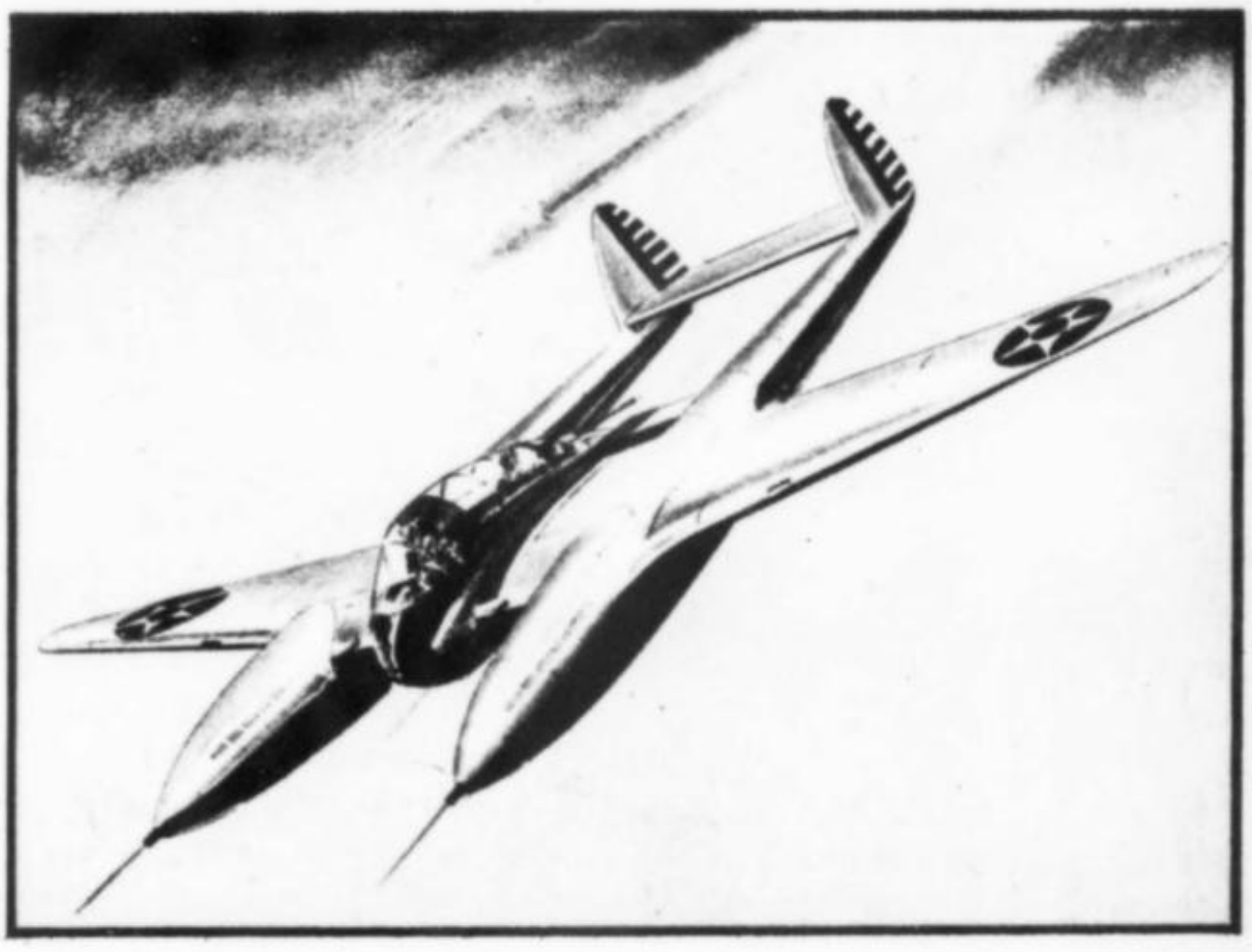


Believe it or not, this is a scene *inside* a Burnelli plane. This one could carry 30 passengers with ease. The car which it carried around the country is shown in place in the cabin. It was driven up a ramp into the ship through one side of the huge fuselage.

completely worked out to build commercial transport planes of practically any size, simply by adding sections to the wing-like fuselage of sufficient width to install another engine and propeller. All the sections would be alike in shape, and each one would contain an engine. Adding sections would make the body wider and wider, until it would carry almost the entire load of the plane in the air. The wings attached to the sides of the giant airfoil shaped fuselage would become relatively insignificant with increases in fuselage width, and function to provide lateral aileron control and lift at landing speed. Anyway, the wings of the ships are designed so that they can be quickly disengaged from the body if the plane should be forced down at sea. The body of the plane then floats like a substantial life boat. Provision is made to release the wings and for a powerful outboard motor to drive it back to land.

But imposing airliners, air freighters, bombers, and tank carriers are not the only aerial advancements Burnelli has conceived. A total of 53 United States Patents and applications and 37 foreign ones have been issued to him. One of the incidental features tested on an early Burnelli plane created a near panic when the ship prepared to land at a neighboring airport. Spectators watched in horror as a sleek pontoon seaplane

[*Continued on page* 174]



This Burnelli design employs a thick wing section between the engine units and center section for lift and strength.

Mine Throwers -- The A

e Answer To The Tank

Mr. Ley, weapons expert for the newspaper PM, pleads for heavy mortars to blast Fascist Panzer divisions.

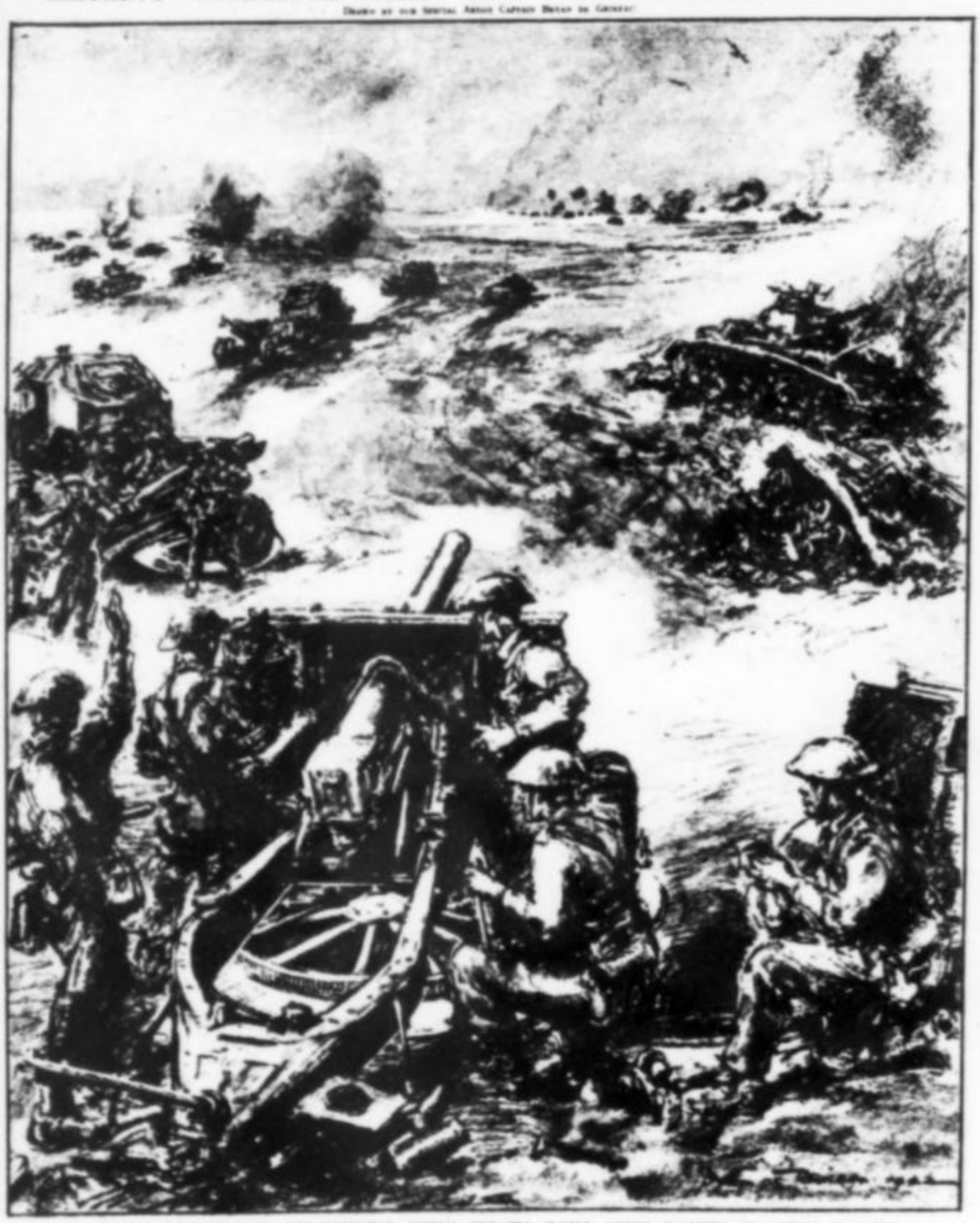
by Willy Ley

War Weapons Expert, Author of "Bombs and Bombing," etc.

IF THE British had had large numbers of heavy "mine-throwers" at Kuala Lumpur in Malaya, they probably would have prevented the Japanese breakthrough at this point and Singapore would not have been lost. Likewise if the Greeks and Australians had had many heavy mine-throwers at Thermopylae they might have succeeded in stopping the German Panzer Units at that point. And, conceivably, the French may have succeeded in preventing the now famous German "Breakthrough at

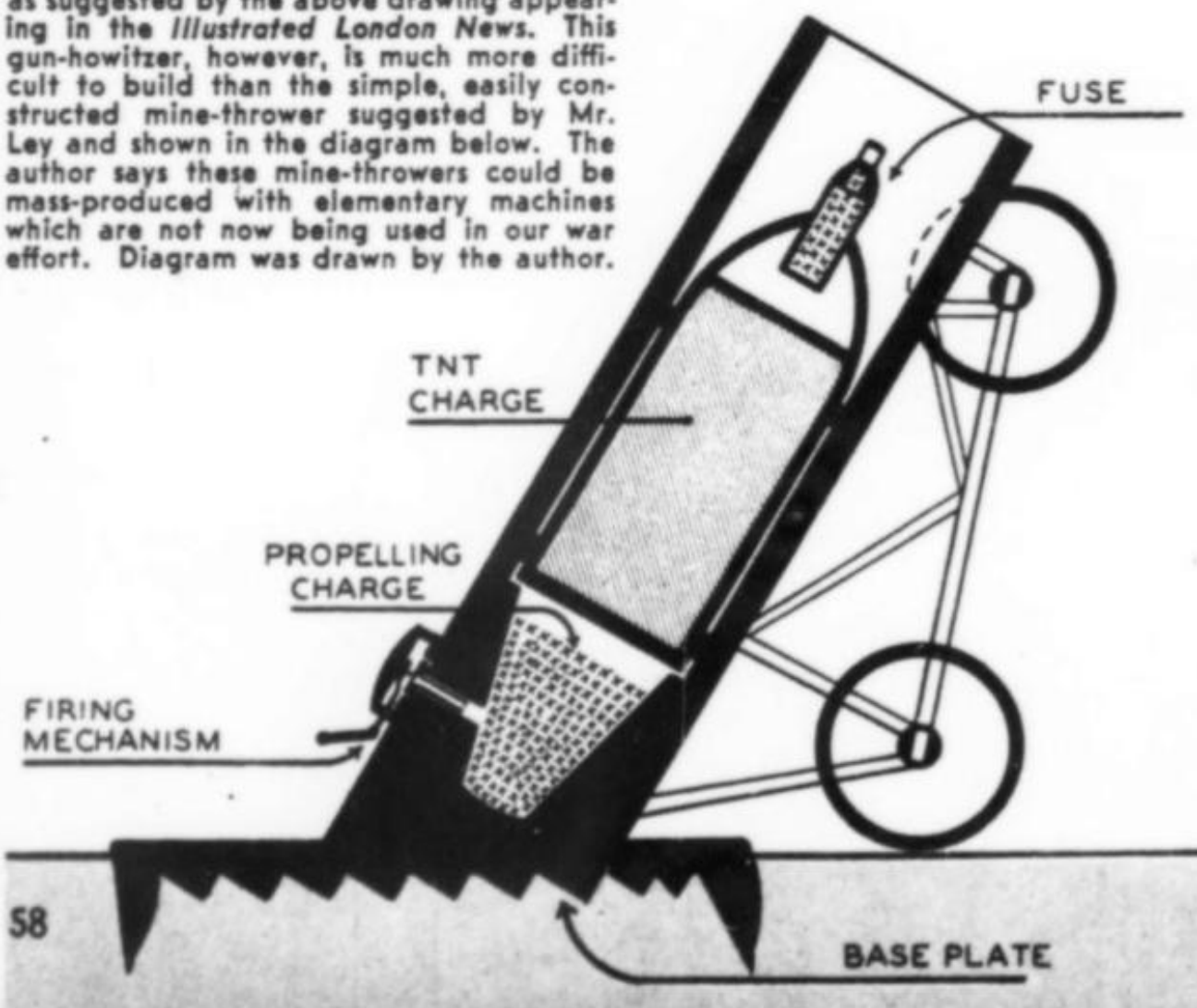
THE ILLUSTRATED LONDON NEWS

BRITAIN'S WONDERFUL FIELD GUN: THE 25-POUNDER IN ACTION.



A BRITISH HIGH-VELOCITY GUN-HOWITZER WHICH CREATES HAVOC AMONG PANZERS, IN ACTION IN LIBYA.

The British are discovering the value of a mobile howitzer gun in fighting tanks, as suggested by the above drawing appearing in the *Illustrated London News*. This gun-howitzer, however, is much more difficult to build than the simple, easily constructed mine-thrower suggested by Mr. Ley and shown in the diagram below. The author says these mine-throwers could be mass-produced with elementary machines which are not now being used in our war effort. Diagram was drawn by the author.



Sedan" which started the Battle of France.

It has to be said, however, that at present there is no such thing as a heavy mine-thrower. The term is to mean a weapon which amounts to a very heavy cannon for short range work, cheap and easy to manufacture in large quantities, just as cheap and easy to operate and accurate enough to halt the advance of an armored column with sufficiently dense fire.

Such a mine-thrower might prove, against present tank attacks, to be as effective as machine guns were against infantry attacks in the last war. It was the machine gun and barbed wire that broke up mass foot soldier attacks. The mine thrower, highly mobile, susceptible to quick mass prdouction, and vastly destructive, might well be the answer to the Panzer. The British have recently discovered that a newly developed gun-howitzer, firing a 25-pound shell, and highly mobile, has created havoc among Panzers in Libya. This is an idea in operation that approaches the idea herewith presented for a mine-thrower. It seems apparent that the mine-thrower would have even greater advantages than the new British gun-howitzer.

While such a weapon does not exist at the present time—at least not to my knowledge—two different weapons that came rather close were in use during the latter part of the first World War and there

Need We Fear Chemical War?

An American plane lays down a smokescreen. The enemy may spray poison gas by the same method.

Here are the facts on poison gas and incendiary bombs and how to guard against them.

by Marshall Perham

NO WEAPON of modern warfare strikes more terror in the uninitiated than chemistry—yet when properly understood, probably no weapon is more easily controlled and nullified. Once chemical warfare meant only the use of so-called poison gases; today, it includes the use of incendiary material. In spite of the world-wide terror of poison gas, if proper defense measures and precautions are used, the incendiary chemistry is the more effective of the two.

With the outbreak of war, the army immediately rushed trained specialists in chemical warfare to all parts of the country that might conceivably be attacked to instruct defense groups. These in turn were to form the nucleus of an instruction corps, that facts and methods of handling a chemical blitz might be property of the public at large.

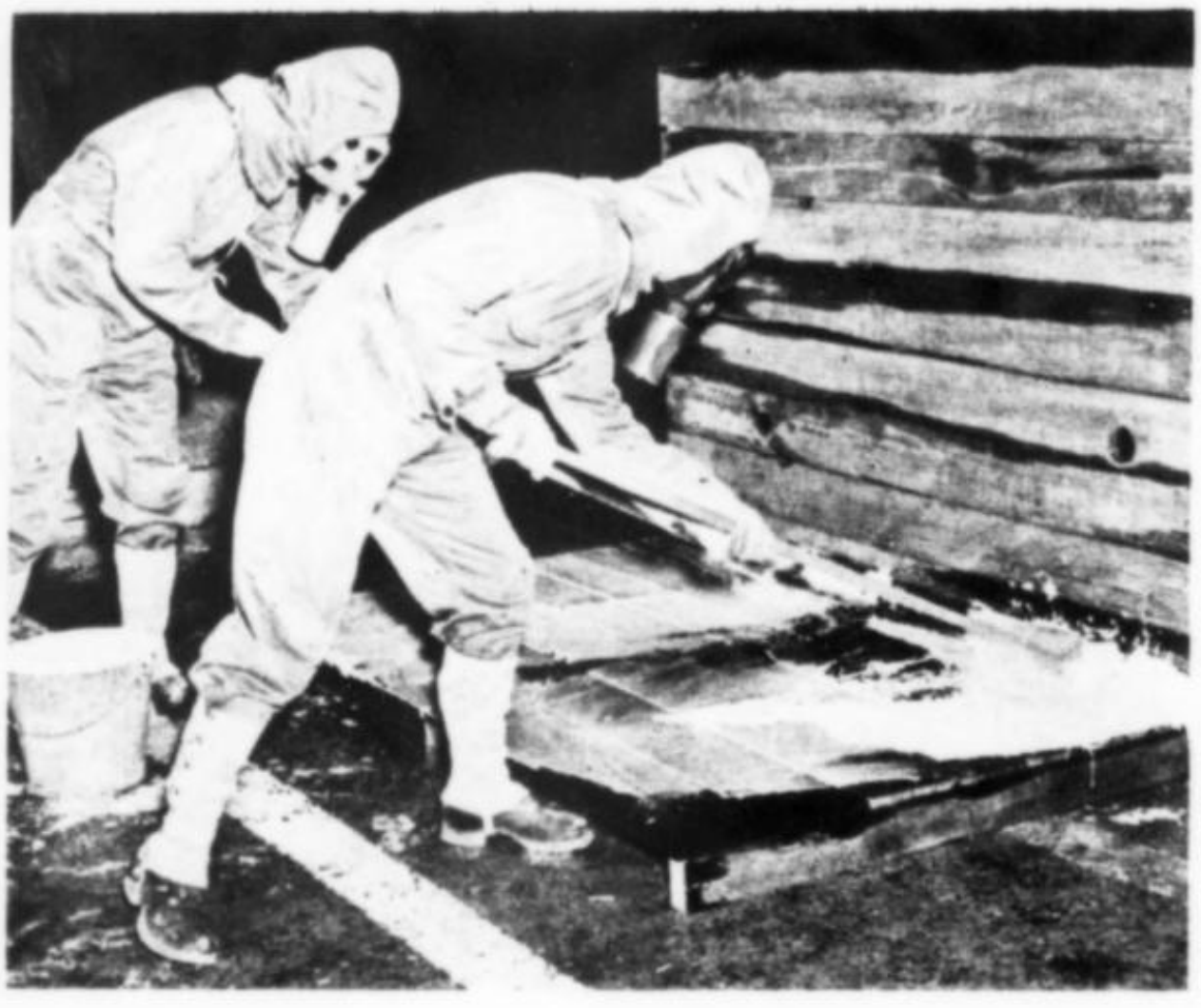
Let's take a look at the various kinds of chemical weapons that might be used against our cities, and see what should be done to combat them.

First, the so-called poison gases. These fall into several classifications. One is the lacrimator, familiarly called tear gas. This is

More terrible, in chemical war, than the worst poisonous gas is the Nazi flame-throwing tank, shown in the photo above.

not a deadly chemical, and is used only to harass persons against whom it might be used. Effects are but temporary, and it is highly unlikely that a surprise attack on any of our population centers would be made by it.

Another classification is called the sternutator. This includes all of the irritant smokes, arsenic compounds, which incapacitate for extended periods by causing violent vomiting, and extreme pains in the head and chest. However, these symptoms wear off in time, with no appreciable ill effects. There is one word of caution in regard to these chemicals, however; any food or drink left exposed to them should be thrown away, since the arsenic will poison them, and render them unfit to eat.



The most deadly type of military gas is the toxic agent, of which phosgene is the most common. This chemical has, at first sniff, a not unpleasant odor, something like green corn. But beware, for death is in that odor. Gas masks are adequate protection against it, but if masks are not available, persons may ride out a chemical attack very safely simply by going indoors; shutting all doors and windows, and putting out fires; the gas is not explosive, but fires create in-

Mustard gas contaminates everything it touches. Left, scrubbing away the gas.

The laying down of an actual gas attack, from portable firing cylinders, is shown above. At right, gas-proof clothing used by soldiers of a Chemical Warfare decontamination unit.

coming drafts. In half an hour, at the most, it is safe to go outside; this gas dissipates very quickly.

Another type of military chemical is the vesicant, most commonly mustard and Lewisite; particularly the former, since it is cheaper. These are not gases, but heavy liquids that lie on the ground and evaporate slowly. If ever you discover such an area, characterized by a heavy, mustard-like odor, get away from it immediately, and notify the proper authorities. If any of it has touched your body, or you think perhaps it has, first call for medical aid, and while waiting, take a good hot bath, preferably a shower.

It is important, however, not to get in a panic about exposure to vesicants. They are poisonous, if breathed for a long time or in very high concentrations, but their main purpose is not to kill but to incapacitate. When they contact any part of the body, especially a moist part, they produce burns, similar to a mustard plaster burn, only much worse. These burns are serious, and require a long while to heal, but seldom have permanent or fatal consequences, except when neglected or very severe.

The other types of poison gases come and go very quickly, but these vesicants are what is known as "persistent agents." That is, they stay around the area affected for a long time. Such areas should be avoided carefully by all except those specially prepared to neutralize them. This preparation consists of special masks, clothing, gloves, and

[*Continued on page* 160]

A FAWCETT PUBLICATION

MECHANIX ILLUSTRATED

JULY
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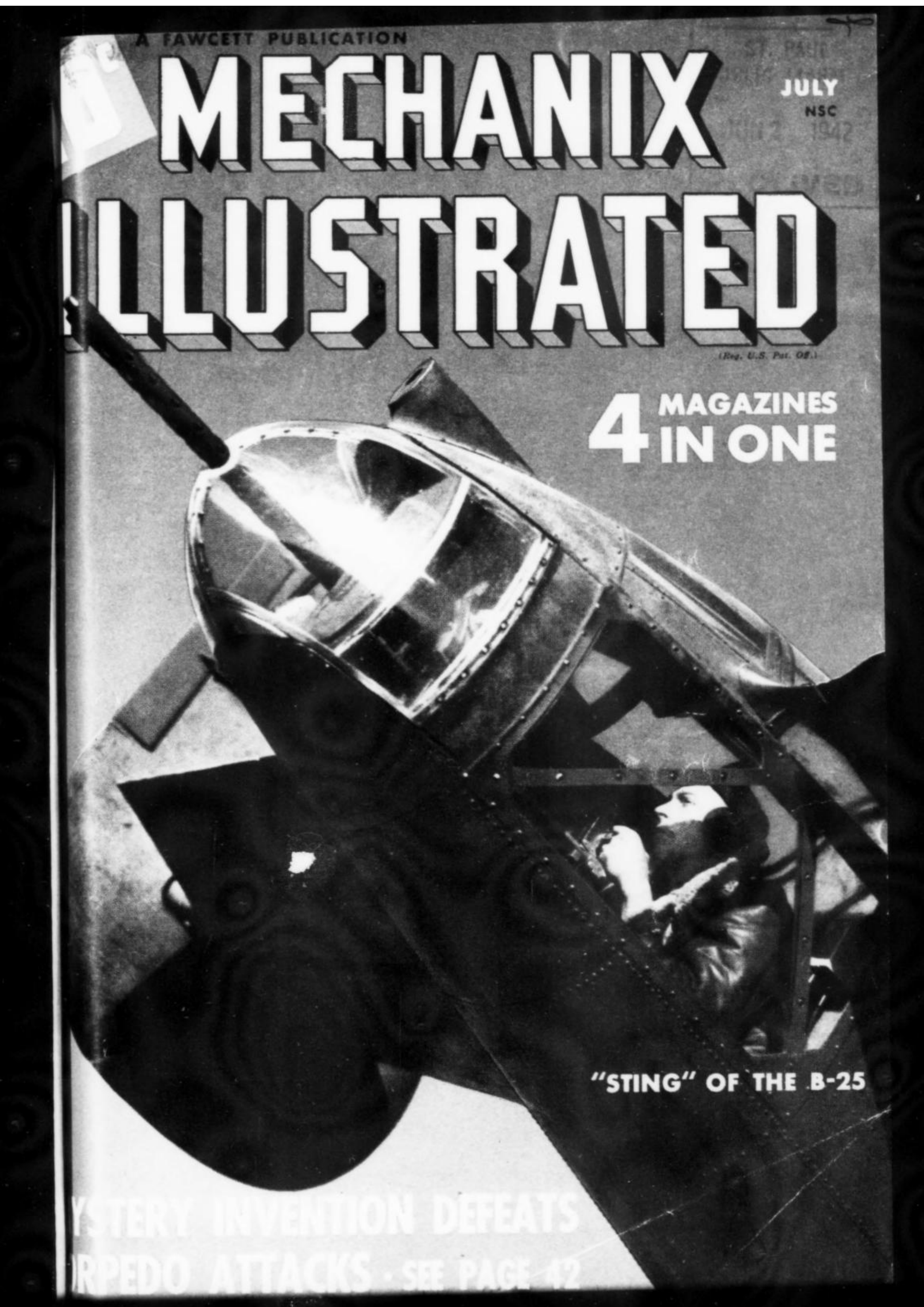
4 MAGAZINES IN ONE



"STING" OF THE B-25

...STERY INVENTION DEFEATS
...RPEDO ATTACKS - SEE PAGE 42

PRICE
10 CENTS

MECHANIX ILLUSTRATED

JULY
1942

Volume XXVIII
Number 3

W. H. FAWCETT, JR., President

Editors
Roland Cueva Bill Williams

Associate Editors: George Daniels, *Aviation;* Norman C. Lipton, *Photography;* Charles D. Bonsted, *News;* Shirley Cutter, *Production*

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SPECIAL FEATURES

On the cover: The tail gunner in this Kodachrome view of a U. S. Army B-25 medium bomber by Rudy Arnold is Corp. Lyle Way, 22, of Lincoln, Nebr. It was hard-hitting B-25s like this that first bombed Tokyo.

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JOHN L. SCHERER

Long-time MI readers to whom the name of the author of the exciting, authentic article "Bombardier" on page 35 looked familiar, deserve credit for remembering old friends. For John L. Scherer, right now an RCAF F/O (Flying Officer), was an associate editor of MECHANIX ILLUSTRATED from June 1936 to mid-April 1939. Born in 1908, he built model planes as a boy, joined the National Guard Air Service in 1927, earned his pilot's license in 1934. Writing about planes and aviation progress for MI just sharpened his long-standing air interest, of course—so much so that he left to fly a plane for the Gannett Newspapers, visiting 46 states in less than two years. Then the RCAF attracted him as it had so many other U. S. flyers; he was commissioned in 1940.

NEXT MONTH

We could end the war in two months! That's what the world's most famous tank designer and builder, J. Walter Christie, says. Mr. Christie should know what he's talking about. There are 30,000 of his tanks on the Russian front today.

Next month, in as amazing an article as you ever read, Mr. Christie tells you HOW we can end the war in two months. Don't fail to buy an August MECHANIX ILLUSTRATED (on sale July 1) to read this outstanding interview with Mr. Christie by George Daniels.

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NOW YOU CAN FLY ST

While Igor Sikorsky sits comfortably in the cockpit of his helicopter, hovering motionless a few feet in the air, an assistant calmly removes one of the landing wheels. The ship floats about without it briefly, then wheel is replaced to land.

An interview with Igor Sikorsky *by* George Daniels

Another dream has come true in the air. Now —not some time in the nebulous future, but right now—you can step into an airship that will fly straight up; an airship that will stop dead in midair and hover there like a hummingbird; an airship that will back up in the air like an automobile does on the ground; an airship that will fit into any ordinary garage, and take off or land in a 50-foot back yard; an airship that you can park in crowded traffic on any metropolitan street. This airship will not stall or spin. And —most unbelievable—you can *turn off its motor* while it is in flight and it will descend to the ground without even a jar!

This sensational flying machine is the helicopter and the man who brought it into being is one of the greats in Aviation's Hall of Fame, Igor Sikorsky. We thought all MECHANIX ILLUSTRATED readers would want to know what is anticipated for this amazing machine by its creator, so we obtained permission to interview Mr. Sikorsky recently and came away with the following approved interview:

IGOR SIKORSKY had a twinkle in his eye when he greeted me in his office at the giant Vought-Sikorsky plant. He's a quiet mannered fellow, but when he talks planes he's as enthusiastic as a kid with a new bike. A few minutes before we met he'd been flying one of the most amazing ships in aviation history, the Vought-Sikorsky helicopter.

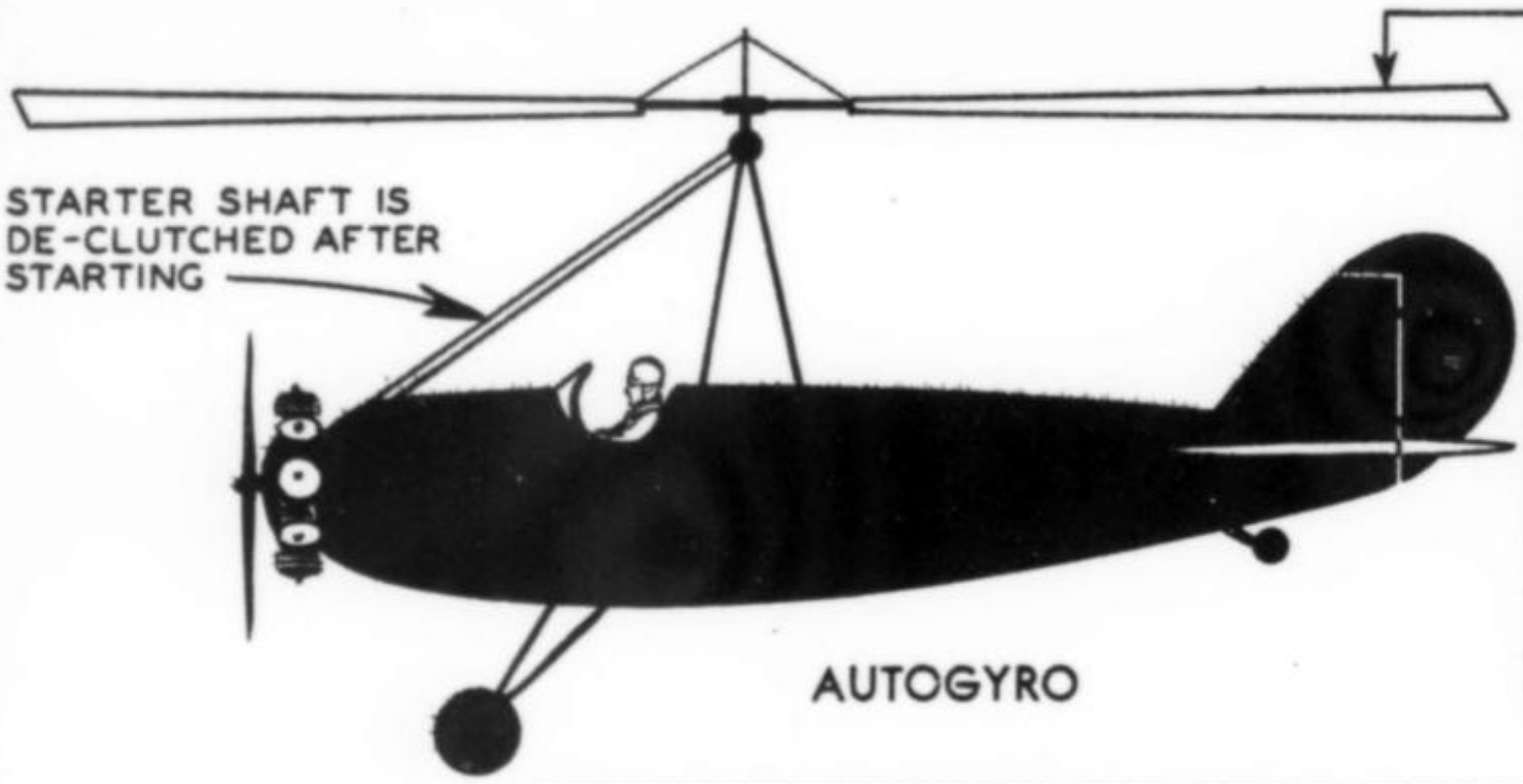
It can fly straight up, land gently straight down, or move easily through the air in practically any direction. It could take off from Bob Smith's backyard, skim swiftly cross-country, and settle down easily to a parking space on the roof of Bill Jones' apartment. And it has it all over the automobile where parking is concerned. It can hover a few feet above a space while the pilot sizes it up, then, literally hanging in the air, it can back up, edge forward, or move sideways in either direction.

Sikorsky has simplified it quite a bit since

Y STRAIGHT UP!

Sikorsky VS-300 helicopter "parks" in mid-air to lower a container to man on jagged cliff.

Plane, Giro, and Helicopter—How They Differ

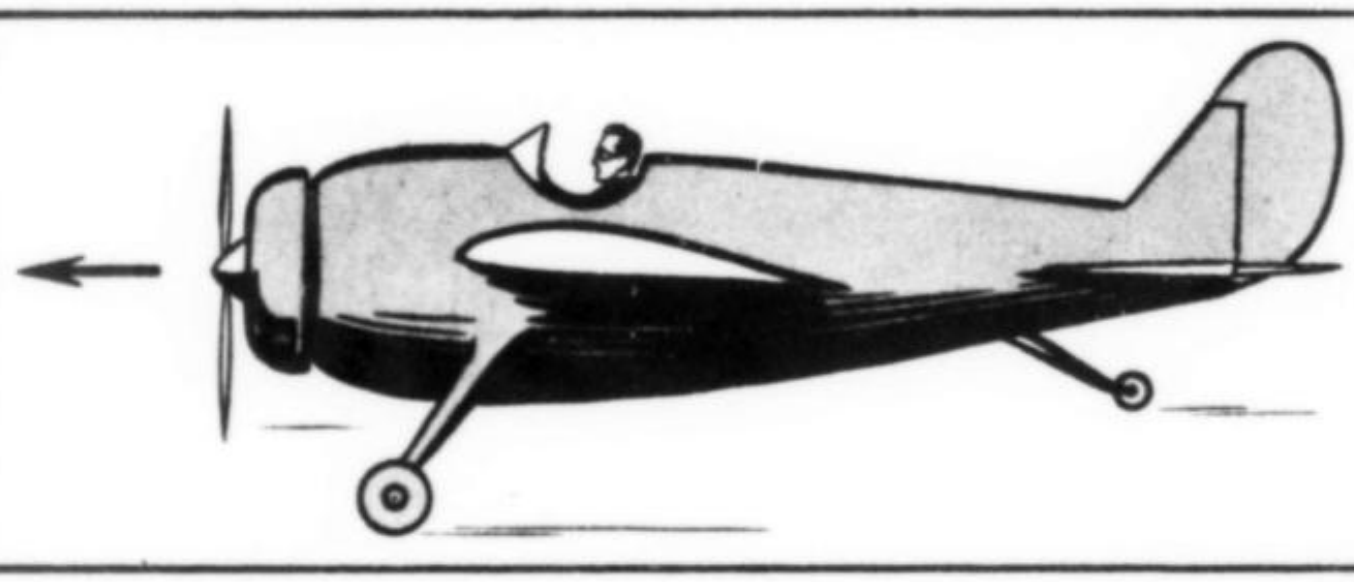


AUTOGYRO

Rotor on autogiro isn't engine-driven except when starting. After that it continues to turn by "autorotation" in much the same manner that a conventional plane tailspins. Autogiros can land straight down safely with or without power, but they can't take off straight up except when "jumped." This method consists of racing the rotor by engine power while blades are at zero lift position—then the pitch is increased, and giro hops up vertically for a short distance. It cannot maintain this vertical ascent after rotor momentum is used up, must then climb at angle while it is moving forward.

CONVENTIONAL TYPE PLANE

Conventional planes must keep in motion in forward direction at all times to fly and maintain control. Prop pulls plane forward, wing in motion lifts it.

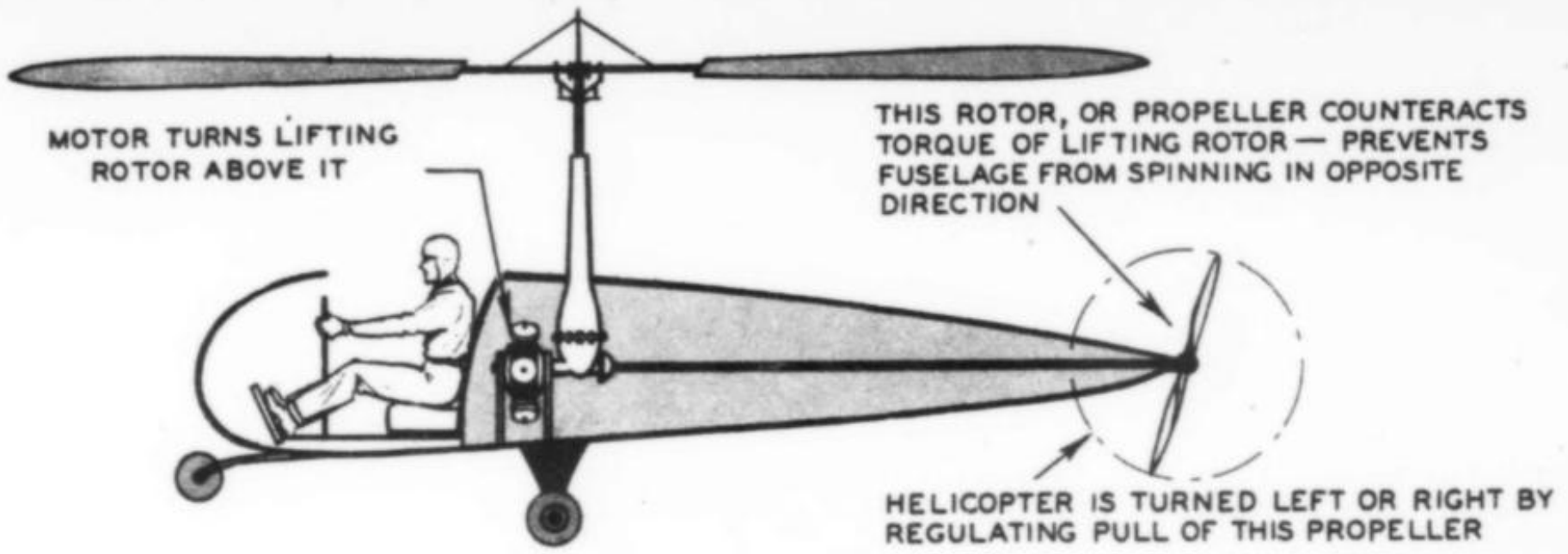


he first designed it. The three rotors originally carried at the tail have been reduced to one, eliminating the outriggers, and bringing the inexpensive privately-owned helicopters of the future that much nearer to reality.

I asked Mr. Sikorsky if he thought that helicopters could be turned out at about the price of a car, and he told me that it all depends on the demand for them. "If there should be a demand for 10,000 helicopters," he said, "they could probably be made to sell at a figure comparable to moderately priced aircraft. If the demand reached the proportions it has for automobiles, the price of helicopters might be reduced to about the same as a medium priced car."

The idea of vast numbers of helicopters hopping straight up from lawns and streets fascinated me. I suggested the term "flivvercopters" for them, and Sikorsky countered with "heli-flivvers." And that's probably what they'll be called when the public takes

Igor Sikorsky was born in Kiev, Russia, in 1899. Began his aviation experiments in 1908, and built the world's biggest airplane five years later. Named the "Grand," the ship dwarfed all airplanes of the time. Since then Sikorsky has gone in largely for giant multi-engined flying boats and amphibians, the majority of his most famous ships having been built during his 22 years in the United States. The VS-300 helicopter is his latest addition to aviation history.

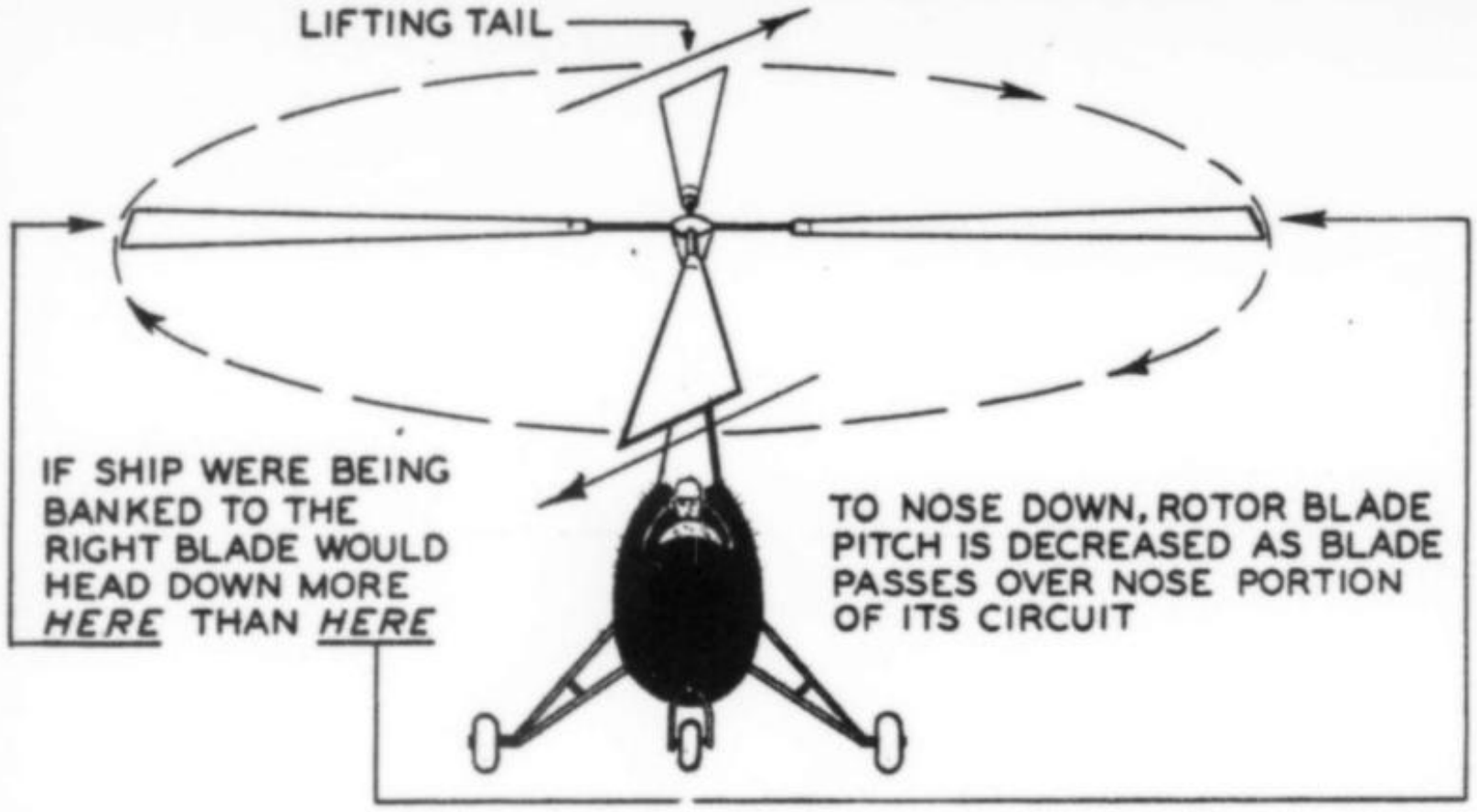


To climb straight up from standing start on ground in helicopter, you pull lever that increases pitch of main lifting rotor and simultaneously speeds up engine. To go forward in the air, you push the conventional airplane-type control stick forward slightly and increase main rotor pitch slightly so added lift can be transformed into forward motion. Tilted, the ship slides forward on level flight path. Process is the same for backward flight except that control stick is pulled back instead of forward. Rudder pedals are used for turns as in conventional plane. These drawings are exaggerated. Top one is simplified to show principle.

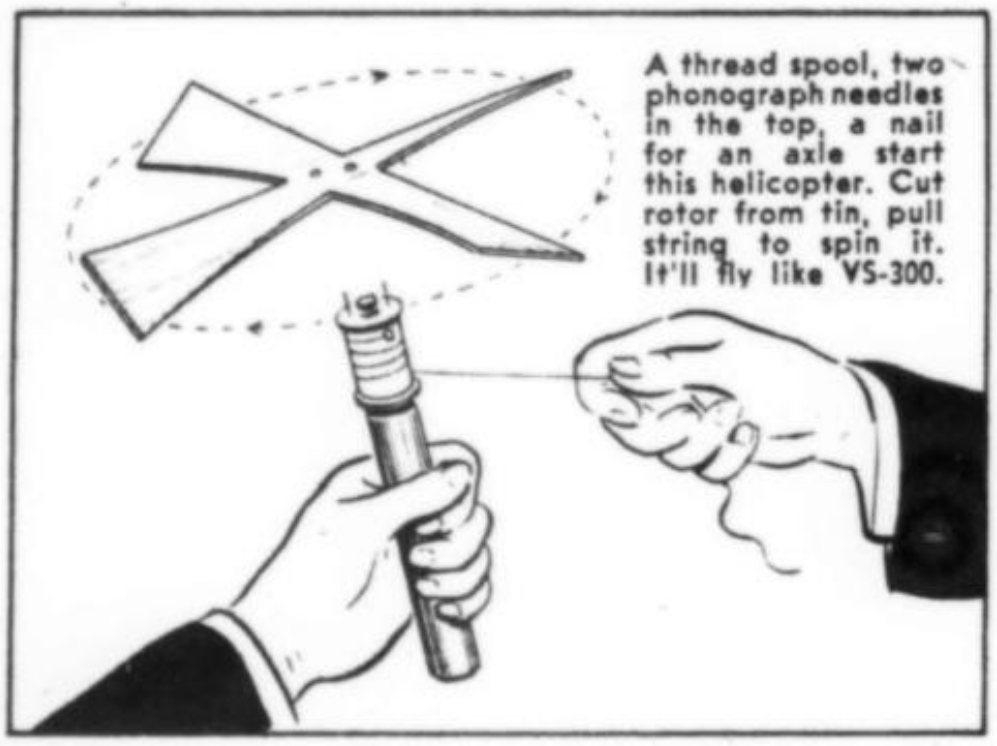
to the sky in them a few years from now. The fact that they can come to a complete stop in mid-air, and remain there, will do much to relieve aerial traffic problems. If you have to stop short when the woman down the street pulls up in front of you from the roof of the hat shop, it'll be possible to hover there for a few minutes while you bawl her out. Then you can back up and continue your flight to the office.

But all that is fantasy, and Igor Sikorsky doesn't deal in fantasy. His incredible ship is real. It's a present day actuality like the mighty Vought-Sikorsky fighters that fly with the Navy, or the huge 40-passenger Vought-Sikorsky VS-44-A now being readied for transatlantic service.

The possibility of mass production of "heli-flivvers" is also very real. To my surprise, Mr. Sikorsky informed me that they can be made with very little duralumin—ordinary aircraft steel tubing being practically the only material needed for their construction. He also pointed out that the helicopter doesn't require any super engines. The same motors that are being turned out by the thousands for conventional planes are also ideally suited to the helicopter. Plants now building auto-



Sikorsky eliminated the two outrigger rotors that acted as ailerons by rigging an individual blade control on the main lifting rotor, as shown at left. This also eliminates need for extra horizontal tail rotor to act as elevator. Control stick changes lift of individual blades as they travel past different points of the circuit, to bank, climb, or dive, or fly on level.



A thread spool, two phonograph needles in the top, a nail for an axle start this helicopter. Cut rotor from tin, pull string to spin it. It'll fly like VS-300.

mobile transmissions for the armed forces can easily produce the other mechanical parts of the helicopter—aside from the standard airplane equipment which is already in production.

Perhaps the "heli-flivver" will solve the post war problem of the aircraft industry by keeping the vast plane factories of the nation running at near capacity, to supply a civilian demand for ships that anybody can fly—anywhere. Igor Sikorsky thinks that might happen. "While it is not possible to predict just how quickly public demand will develop," he said, "it seems reasonably certain that the

Below, Sikorsky's helicopter slowly pokes its nose through dead center of 12" loop on pole, then holds it there.

Trees

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Trees don't bother Sikorsky when he takes off and lands his helicopter. He's landing straight down in this photograph.

helicopter will absorb a considerable part of the industry's productive capacity when military orders are reduced after the war."

But the little 2-passenger jobs are not the only type of helicopter that Sikorsky has been thinking about for the future. He told me that larger ones could be built to carry as many as 20 passengers. These would serve as flying buses, between metropolitan areas and airports, for he does not believe that the helicopter will ever replace the airplane for high speed long distance travel or for carrying heavy loads. He sees it as an efficient means of pleasure travel and commuting.

He doesn't believe that the top speed of true helicopters will get beyond 150 miles an hour, nor that the passenger capacity will exceed 20 persons. The conventional airplane, on the other hand, can attain immense proportions. "Even at the present time," he said, "we could build a 1,000-passenger airplane along conventional lines." [*Continued on page* 174]

NOLOGY

AVIATION • INVENTIONS • HOBBIES

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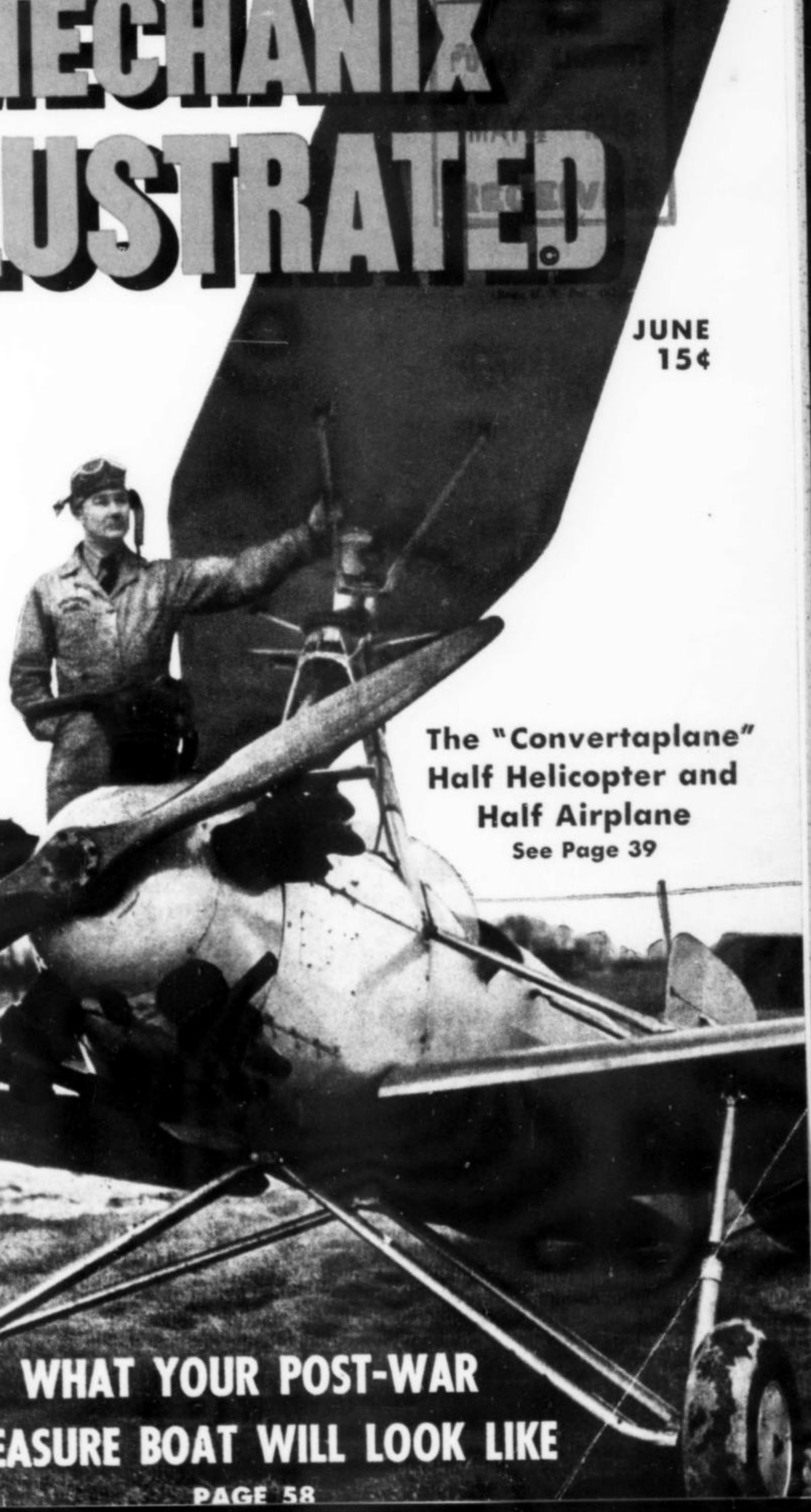

The "Convertaplane" Half Helicopter and Half Airplane

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WHAT YOUR POST-WAR PLEASURE BOAT WILL LOOK LIKE

PAGE 58

JUNE 1943

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SPECIAL FEATURES

On the Cover: The first published Kodachrome of Gerard Herrick's Convertaplane, the amazing new aircraft which is considered by many the leading contender for the title of Family Plane of the Future. For its inventor's story about the Convertaplane, see page 39. Kodachrome by Norman C. Lipton.

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NEXT MONTH!

Are you planning to take a vacation this year? If you are, you're probably worried about obstacles like gas rationing and the rubber shortage, and may feel that you'll have to stay somewhere pretty close to home. But you don't! In next month's MECHANIX ILLUSTRATED you'll find complete information on the most interesting and unusual vacation trip you ever heard of—the kind of trip you've always dreamed of making some day. And you don't need an automobile for it at all! So before you settle the plans for your vacation this year be sure to read You Can Go Canoe-Camping in the July MECHANIX ILLUSTRATED.

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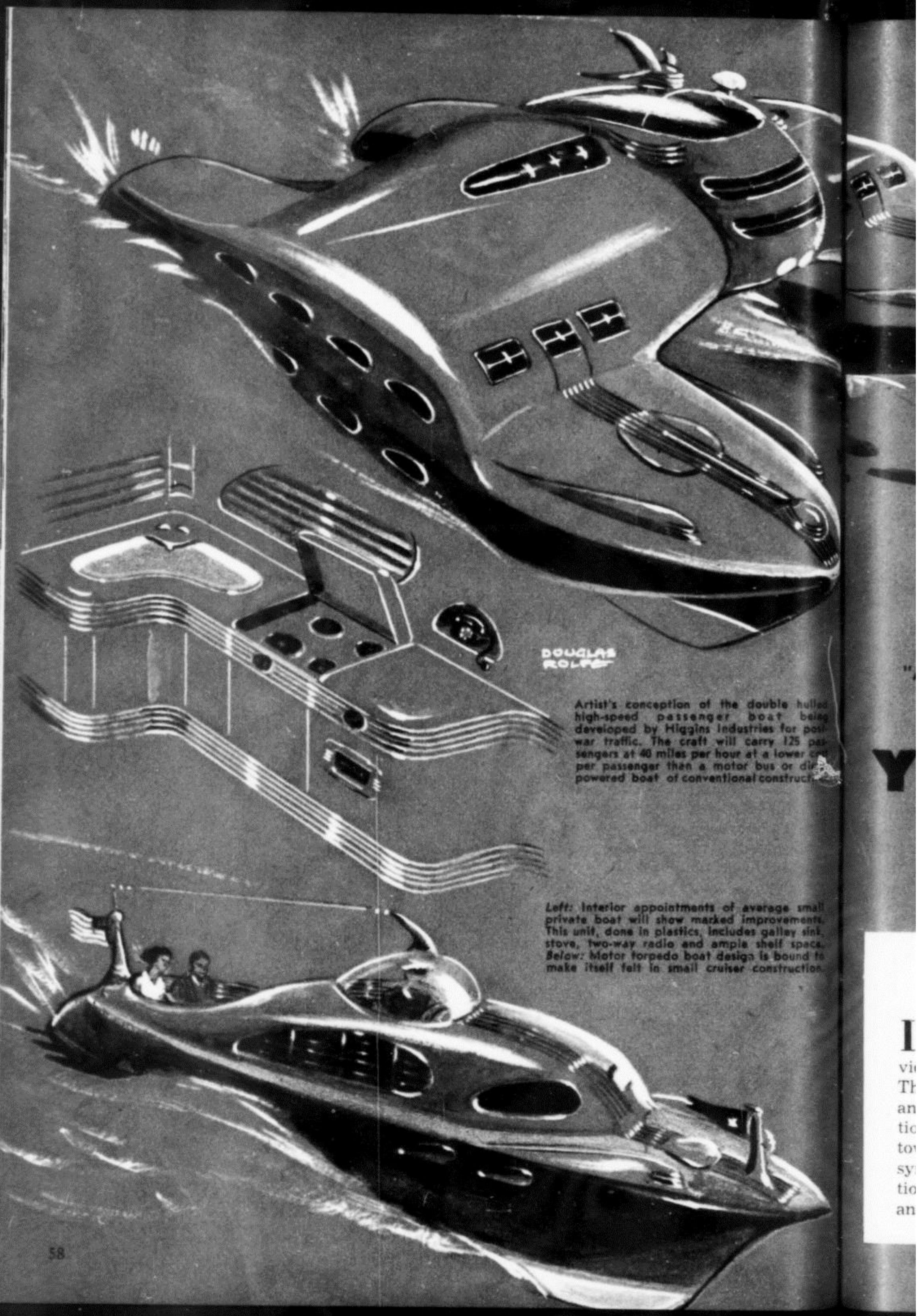
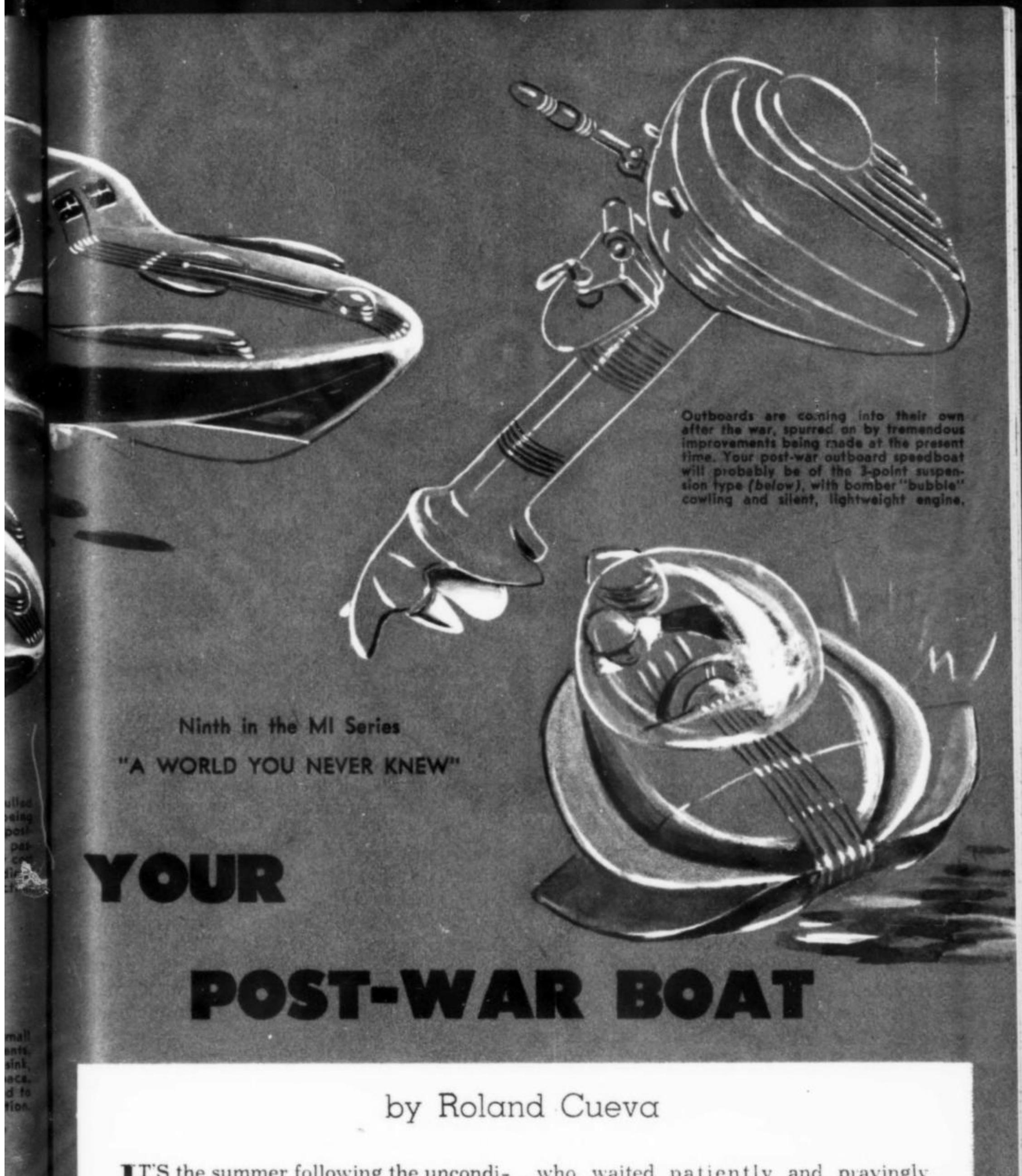


Artist's conception of the double hulled high-speed passenger boat being developed by Higgins Industries for post-war traffic. The craft will carry 125 passengers at 40 miles per hour at a lower cost per passenger than a motor bus or diesel powered boat of conventional construction.

Left: Interior appointments of average small private boat will show marked improvements. This unit, done in plastics, includes galley sink, stove, two-way radio and ample shelf space. *Below:* Motor torpedo boat design is bound to make itself felt in small cruiser construction.



Outboards are coming into their own after the war, spurred on by tremendous improvements being made at the present time. Your post-war outboard speedboat will probably be of the 3-point suspension type *(below)*, with bomber "bubble" cowling and silent, lightweight engine.

Ninth in the MI Series

"A WORLD YOU NEVER KNEW"

YOUR POST-WAR BOAT

by Roland Cueva

IT'S the summer following the unconditional surrender of the Axis to the victorious armies of the United Nations. The war has been over for eight months, and you're enjoying your first real vacation in almost three years. You drive toward the beach with a light heart, new synthetic tires and a tank full of unrationed gas. In the back are your kids and fishing tackle, beside you the wife who waited patiently and prayingly through all the dark hours while bombs and shells were shaking the ground under your feet and molding the substance of her dreams. You've never felt happier in your life, and you can hardly wait the fifteen minutes needed to span the twenty-odd miles to the beach via the new express highway.

Newest wrinkle in modern mechanized warfare is the amphibian jeep, shown above during trials in the Detroit River. With four wheel drive, the jeeps can travel with equal facility on land or water. They are the forerunners of a new type of transportation sure to come after the war, and may represent a preview of your own post-war boat.

"Did you remember to get a weather report?" says the little woman.

You'd forgotten, but there's nothing to it. Reaching forward, you flip the dashboard radio switch to *telephone* and get a detailed report direct from the nearest Coast Guard Station. Fair and warm with light S.W. winds all week, they say, except Wednesday when there'll be a brief shower about 4 p. m.

The remaining eleven minutes go fast, and the ramp across the beach appears ahead. You drive over it and— "Hey, mister, what are you doing? Stop, you're driving right into the water! You'll be wrecked, killed, drowned, you'll—"

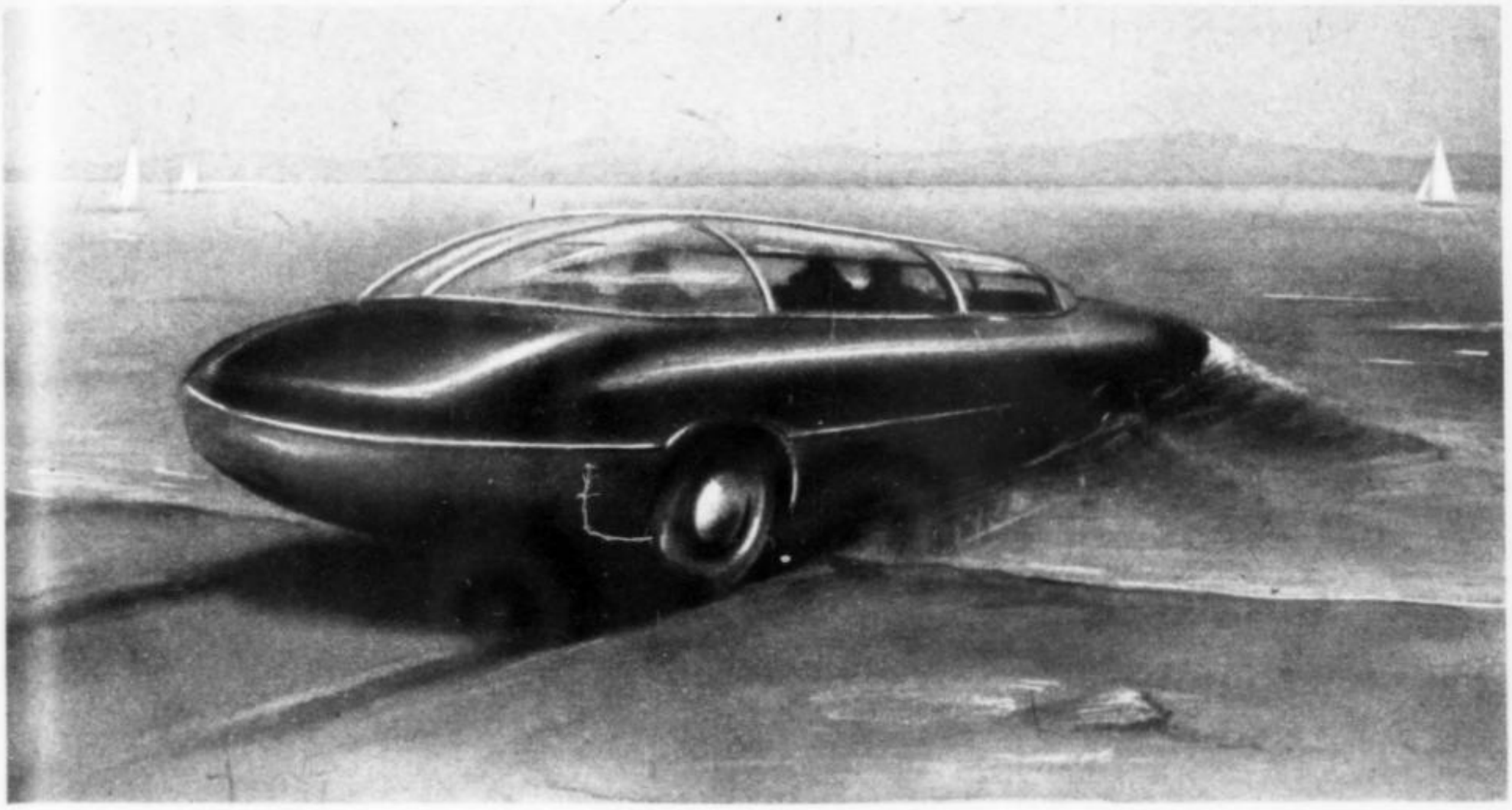
"Take it easy, chum, nothing is going to happen. We're just goin' fishin'. This is our new amphibious peacetime jeep . . . it's *supposed* to go in the water. See those other fellows out there? They all have 'em too. You just drive right down into the waves, shift from wheel drive to 'prop,' and there you are, riding like a duck. They'll make ten knots, and they're really seaworthy, though of course you want to head for shore if a bad line squall comes up. That's another beautiful point about these jobs. You don't have to anchor and sit out the blow, hoping your ground tackle will hold. You just drive ashore and go home."

In the light of today's mechanical and scientific war developments, there's nothing exaggerated about the foregoing picture, except, perhaps, the miraculous weather report. There's no reason to suppose that boat design will stand still while land and air transportation forge ahead, even though water-borne craft are bounded by more stringent natural laws than the other two, particularly in the matter of surface friction. Boats can never hope to attain the speed of airplanes or automobiles, though certain racing craft have done better than 100 m.p.h. in calm water, and the remarkable PT boats can make time even under adverse weather conditions.

But these are specialized cases, and it is an axiom of naval architecture, as in life itself, that you can't have your cake and eat it. Where something is gained in boat and ship designing, something else is invariably lost. Actually, there's no reason why boats *should* have excessive speed built into them, for their value lies in other directions, and the post-war speed addict had best take to the air. This doesn't necessarily mean that the speeds of various types of vessels will remain at pre-war levels, with the possible exception of heavy cargo ships, where economy of transportation is the principal factor, and high speed too costly. Your post-war power

Continued

Your Post-War Boat



When you want to go boating after the war you may just drive your peacetime jeep down to the beach and right on into the water. Think of the toll bridge money you'll be able to save when driving across country!

Out of water the amphibian jeep looks like this. The "bilge" has ample road clearance, a paradox come true. A winch on deck aids in climbing out of the water up steep banks. No hauling out or mooring problems with one of these!

cruiser, for instance, influenced by motor torpedo boat design, built of lighter materials and driven by a lighter, more powerful engine will undoubtedly average ten or fifteen knots faster than today's equivalent.

Streamlining, so vital at 300 m.p.h. means little at 30, and in the case of boats, can only be applied to the superstructure, the area where skin friction is of least importance. It is true that fish are streamlined, and so are submersibles, but the underwater shape of surface craft represents an entirely different problem and is governed by considerations of bouyancy, stability and intended purpose of the boat.

An example of this would be a medium-sized fast passenger and cargo vessel. The sharp bow must co-operate with the engines to break a path through the waves with maximum efficiency. The bilge, or central portion must be full enough to provide ample space inside the ship, keep it stable and yet allow the water to flow past with a minimum of friction. The stern must be shaped to lift easily to following seas, decrease "drag" and must also provide the mighty propellers with an uninterrupted torrent of nonturbulent water. Right here is where the ship's performance is determined. Whether the topsides look like a teardrop or a boxcar makes little difference, except in eye appeal. These are facts which will hold just as much after the war as now. There will be certain

MECHANIX ILLUSTRATED wishes to express its sincere thanks to the following naval architects, designers and boat and yacht corporations for their co-operation and assistance in gathering material for this article:

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Mr. Walton Hubbard, Jr., Hubbard's South Coast Company, Newport Beach, Calif.
Mr. J. Murray Watts, Naval Architect, Philadelphia, Pa.

Wartime tank-landing barges can be adapted for river and lake transport, eliminating dock and warehouse facilities. Here one portages a falls.

Continued

Your Post-War Boat

exceptions—craft designed for specific purposes (see illustrations) but generally speaking the principal improvements in cargo and passenger vessels will be in freight handling equipment and accommodations. Smaller ships will be the rule. The huge uneconomic super luxury liner is almost certain to vanish from the seas and join the sailing ship in oblivion.

In the field of pleasure boats the picture is somewhat different. Here economic and weight-carrying problems are of less importance, consequently, far greater freedom of hull design and construction materials is possible. There seems little doubt that many of the sail and power boats dotting our lakes, rivers and bays will be startling, if measured by present standards.

Two tank-landing vessels, above, land materiel directly on the shore. Such vessels can be used for peacetime operations as shown on *opposite* page.

The amphibious jeep mentioned a while ago is one example, and has its counterpart in the new amphibian of the same name being built in large numbers for the Army. But maybe you won't want a boat that makes like an automobile. All right, how about a non-magnetic cabin cruiser that will never have to be caulked or painted; that's rot proof, corrosion proof and worm proof, making 45 knots with an engine no bigger than the auto-conversion in your present boat? And we'll throw in a two way radiophone to boot.

This is no fantasy, and furthermore, such a boat will probably cost *less* than the one you have now. It won't be done with mirrors, but with modern plastics, metal alloys, plywood and other materials from the miracle-laboratories of science. Your cruiser will be molded or planked with tough, phenolic-resin bonded plywood, surfaced with resilient plastic in any desired color. This plastic will be highly resistant to scratching or other contact damage, but should such occur will be easily repairable. It will have a smooth, permanently beautiful luster that sun and water will leave undimmed. Under this impervious skin will be a skeleton of light-weight non-corrosive alloy, having strength and longevity unknown to wooden frames. The deck and trunk cabin will also be plastic-faced plywood, or perhaps pure sheet and molded plastic, of a non-skid variety. You won't have to worry about slipping off in wet weather, and you can bang the anchor against topsides and deck to your landlubber heart's content, without fear of damage.

Below, your cruiser will be a thing of beauty and comfort such as you've never dreamed of. Colorful plastics, cleaned by a swish of a damp cloth will replace grimy woodwork, and the galley will be practical as well as attractive. The ship-to-shore radiophone will make it possible for you to get accurate weather reports, or talk to your office. You could even call up your mother-in-law in North Dakota from the middle of Block Island Sound, should you be so inclined.

Under the cockpit floor will repose the processed herd of horses needed to push your boat at high speed. The herd will take the form of a light, compact gasoline or diesel engine having enormous power-to-weight ratio, yet extremely economical in operation. Some such motors have already been developed for the Army and Navy—others are on the drafting boards.

Maybe you're a windjammer enthusiast, or possibly your taste runs to outboards. In both these types of craft, you'll see many changes. Hull shapes for sailboats won't alter

Continued

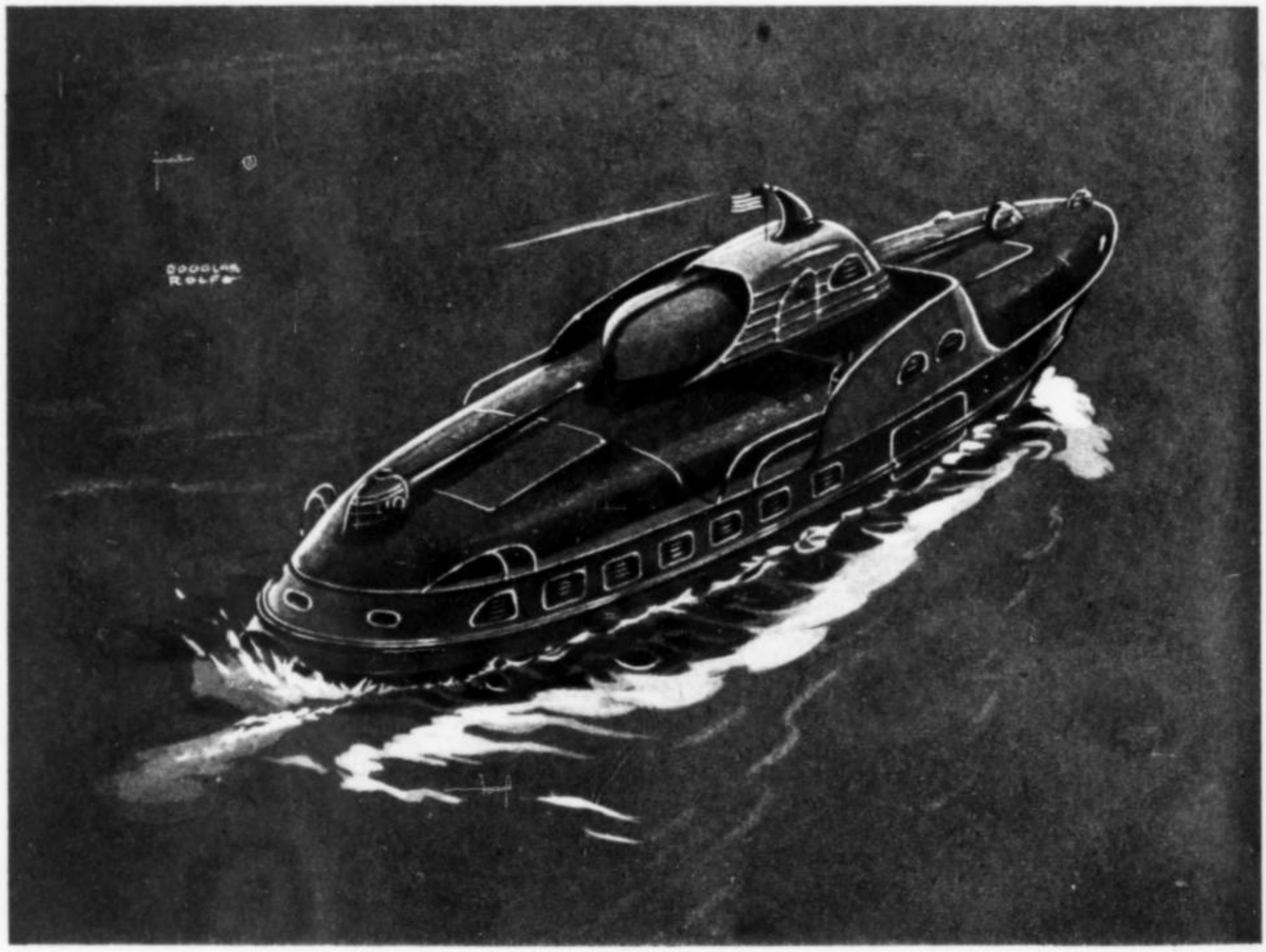
Your Post-War Boat

much, neither will their sails, for specialization requires them to be about the way they are. But when it comes to rigging and sail *handling* the story will be different. Here again soybeans, synthetics, and the metallurgists come into their own. Cleats, chocks, blocks, bitts, sail track and other fittings will be of high-tension plastic; just as durable and far cheaper than the metal ones in common use today. New stranded stainless alloys of tremendous strength, borrowed from the aviation industry, will take the place of clumsy wire rope rigging. Redesigning of running rigging (the ropes used to handle the sails) will put most of it out of sight inside hollow spars, giving the boat a trimmer appearance and avoiding the dangers of fouling lines in the event of a sudden blow.

Your post-war outboard boat will be something to marvel at, and a long swim from the present noisy putt-putt. Wartime improvements in these motors have been outstanding, and today the Army landing barges, assault boats and other small craft are equipped with outboard motors that are as powerful and silent as softly whirring dynamos. Development of new heat-resistant non-corrosive metals, high octane fuel and quiet, underwater exhausts are principally responsible. When you hitch one of these light-weight cyclones to your 3-point suspension hull you'll really go places in a hurry.

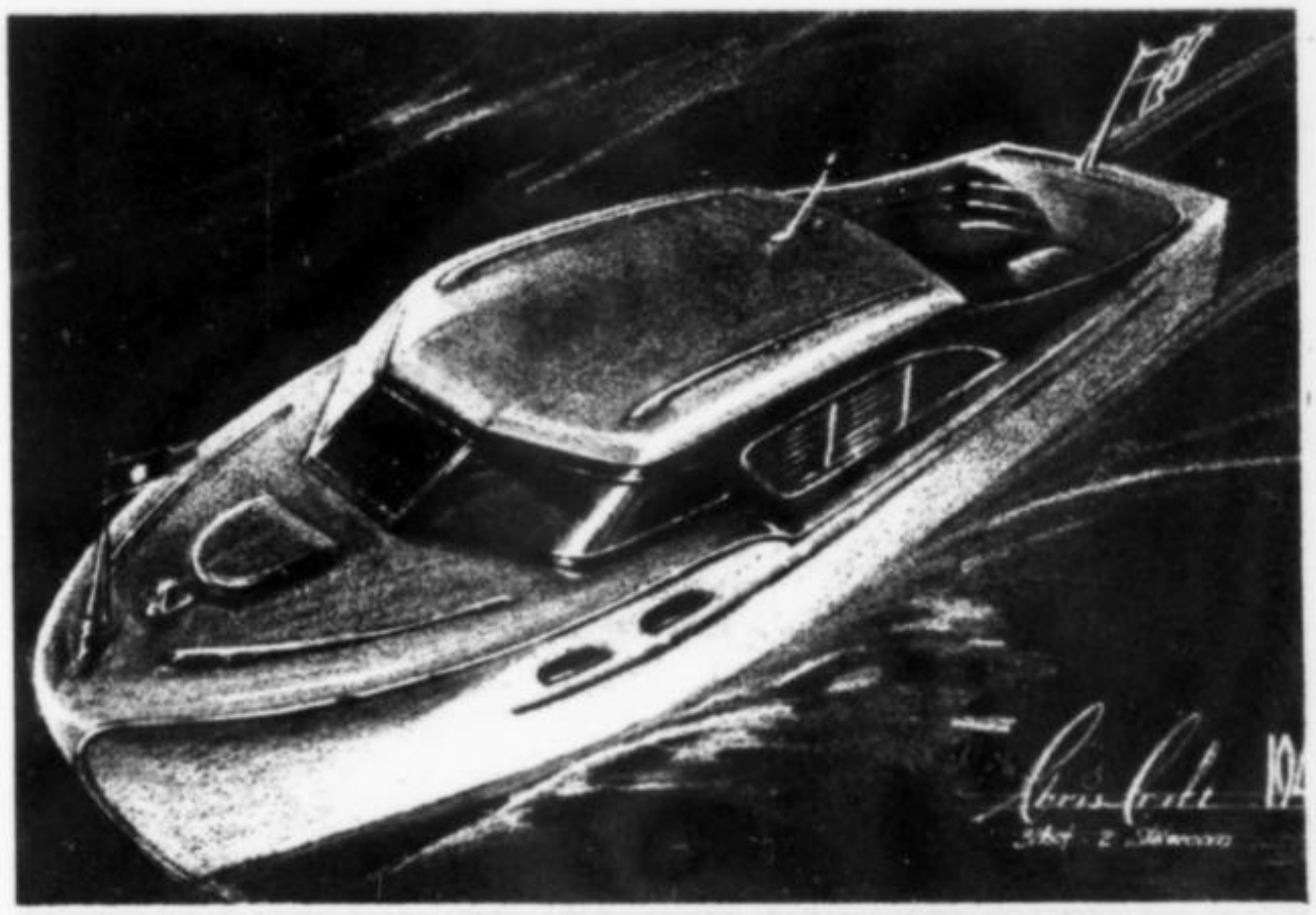
It is in the field of marine engines that many of the most progressive refinements are likely to occur, and they are almost certain to follow the general trend of automobile and aviation engines. For instance, up to now most marine engines built for pleasure craft have had gray iron cylinder heads because salt water is extremely corrosive to the aluminum used in high-compression car motors. The discovery of corrosion-proof dural, beralite and other aluminum and beryllium alloys make this no longer neces-

Below: An example of specialized post-war boat planning. This craft, an 85-foot passenger and cargo vessel, was designed by J. Murray Watts, N. A., for use on the shallow Mackenzie River in the Canadian Northwest. A gale of wind blows almost continually from the north down the Mackenzie, and boxy stern-wheelers could make little headway against it. Watts' vessel has tunnel stern, is almost perfectly streamlined, with flush hatches and cargo booms. It will operate swiftly and economically.

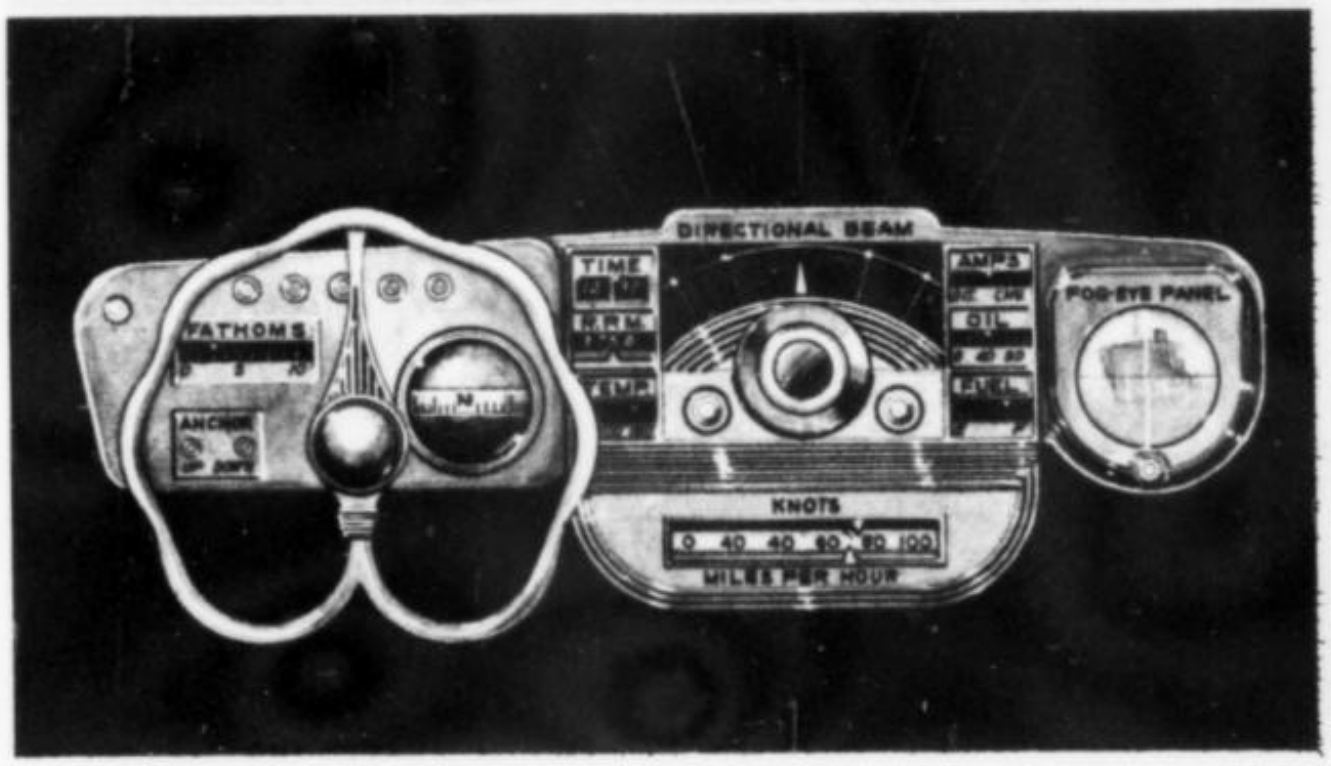


sary; coupled with high octane gas they will bring small, powerful motors to the boating public.

As a matter of fact, a post-war boat having this type of engine has already been designed for a prominent Mexican by one of America's leading yacht designers and naval architects, J. Murray Watts. The boat, to be built as soon as the war ends, will be 38 feet long, of triple-skin plywood construction. A 12 cylinder supercharged Packard engine delivering 1,500 h.p., and weighing no more than a 150 h.p. pre-war motor will give the cruiser a speed of better than 50 m.p.h. Mr. Watts, incidentally, has been a leader in the development of all metal hulls for small boats, and recently completed a 45-foot yawl of "Birmabright," an aluminum alloy having great tensile strength. She displaced only 12½ tons, as compared to 14 tons for a steel vessel of equal strength.



Post-war power cruiser projected by Chris-Craft. Light, powerful engines and wide employment of durable plastics will be featured in boats like this.



Easy-grip wheel, radio directional beam equipment, depth indicator, automatic anchor haul and fog piercing television device may make the helmsman's task simple in tomorrow's boat, whether he be guiding small pleasure craft or ocean liner.

Diesel engines, heretofore impractical for small craft because of their low power in relation to tremendous size and weight, will finally become available to the little fellows. Great strides in diesels were being made even as the war started, and while progress since has been shielded by the necessity of military secrecy, we can safely guess that when the veil is lifted, results will be astounding. There is no doubt that light, small diesels delivering real power at low initial cost and upkeep will be produced in large quantities. And there is no doubt that the manufacturers will find a good market among the builders and owners of boats in the 30- to 65-foot class.

While we may reasonably expect to see the most spectacular achievements in the realm of specialized design, new materials, engines and "gadgets," the so-called fundamentals will not be neglected. A good many of tomorrow's yachtsmen are today's Naval, Coast Guard and Auxiliary personnel. When they return most of them will not only have boats and salt water in their blood—they'll know a good boat when they see one, and they'll know a bad one too. Beautiful galleys and gewgaws are fine, but they won't be enough. These men will have been trained to the exacting construction standards of the U. S. Navy, and will be able to see right down through all the trimmings in the world to the boat's "vitals." Their minds will be open to sound refinements, of course, but finish will be secondary to ruggedness, seaworthyness, comfort, plus greatly improved mechanical and electrical features.

From the production standpoint, it is doubtful that boats will ever come near the peaks attained by the automobile and aviation industries. It is true that the boating public will probably [*Continued on page* 132]

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DIVER BATTLES OCTOPUS

HOW WOULD you like to battle a 24-foot octopus 20 fathoms under the sea? That's the thrilling life and death adventure of Lieut. Harry Rieseberg, whose diving bell was attacked by a monster squid. Eight tentacles studded with pores, each with a suction capacity of 19 lbs., flayed the bell, knocked its occupant unconscious and tried to drag it to a hidden underwater haunt. Read how Lieut. Rieseberg killed the octopus and filmed the stirring battle from beginning to end. These pictures, the most spectacular ever recorded in history of a battle between a man and an octopus, will be shown in the February issue of MECHANIX ILLUSTRATED.

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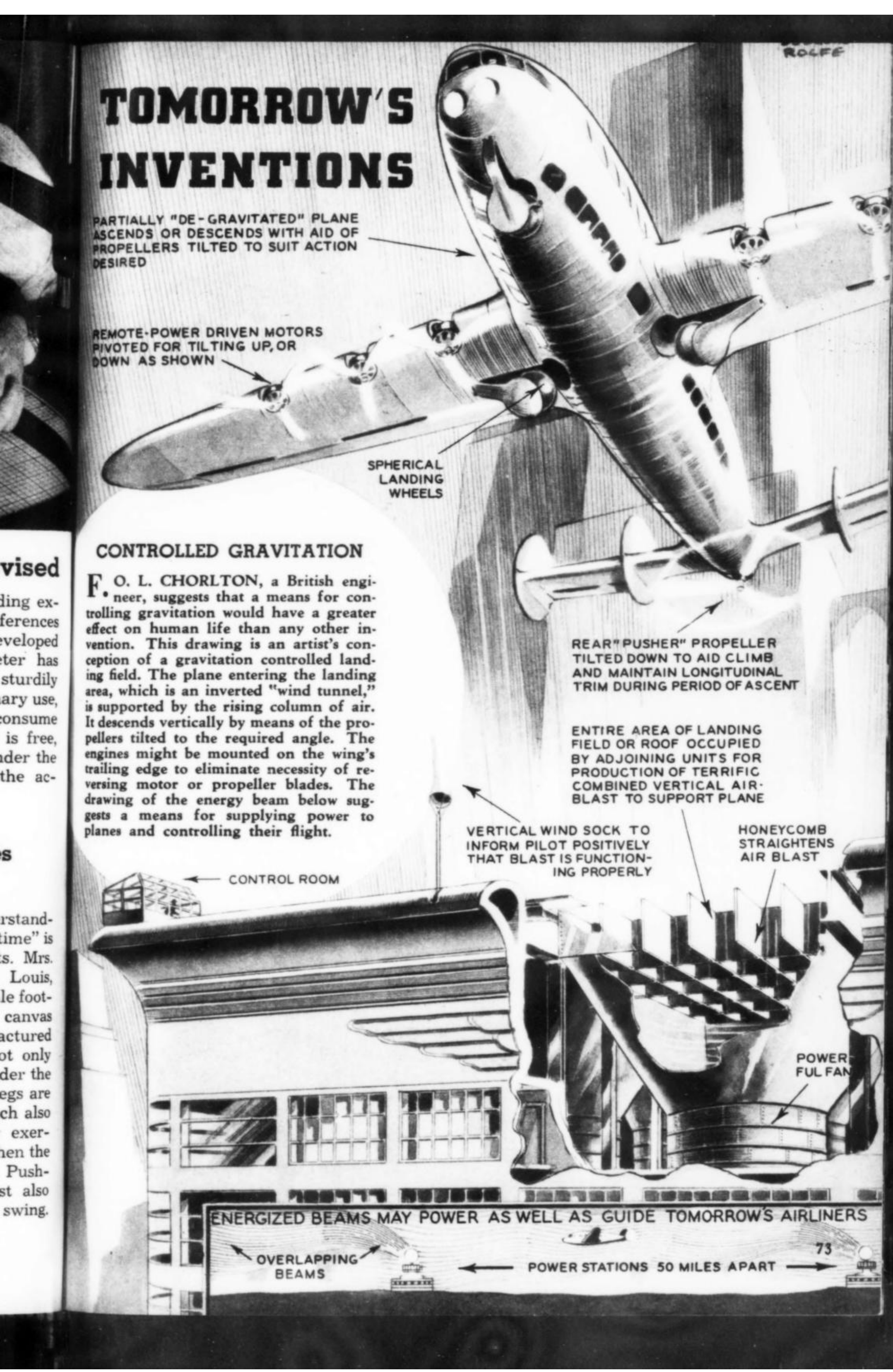
TOMORROW'S INVENTIONS



CONTROLLED GRAVITATION

F. O. L. CHORLTON, a British engineer, suggests that a means for controlling gravitation would have a greater effect on human life than any other invention. This drawing is an artist's conception of a gravitation controlled landing field. The plane entering the landing area, which is an inverted "wind tunnel," is supported by the rising column of air. It descends vertically by means of the propellers tilted to the required angle. The engines might be mounted on the wing's trailing edge to eliminate necessity of reversing motor or propeller blades. The drawing of the energy beam below suggests a means for supplying power to planes and controlling their flight.

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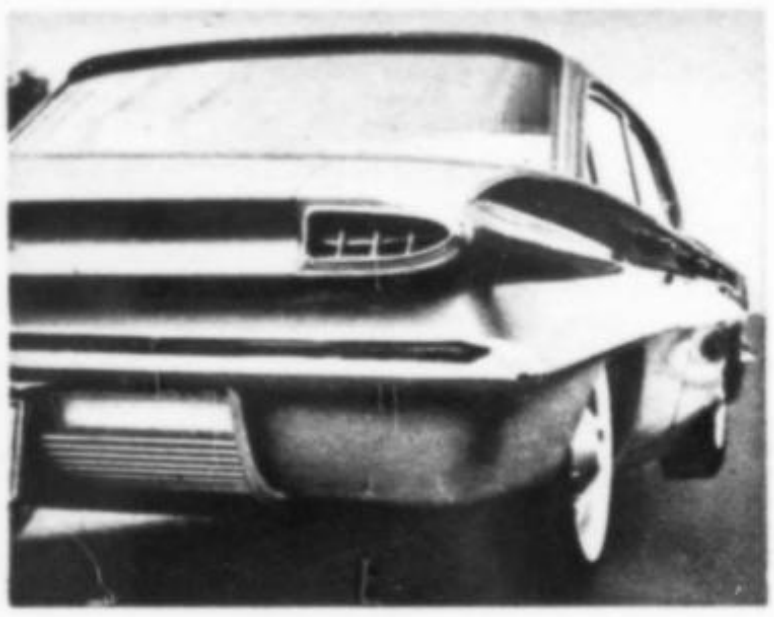

WHAT'S THAT CAR? It's one of the new 1961 models—but you'll have to see the October MI to find out which one! In next month's Special New Car Section you'll find photos and facts on the first of the new cars, including a host of compacts you've never seen before. In addition to all this, you'll read two sprightly tests by Uncle Tom McCahill, dean of America's car-testers. Remember—the October MI will give you your first look at the '61 cars! On your newsstand Sept. 27.

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SEPTEMBER, 1960

Volume 56, Number 9

IT'S NEW

VTOL FIRST: the Short SC-1, made in No. Ireland, is the first to go from vertical to forward flight, back again to vertical. It has four Rolls jets for vertical thrust, one for forward.

SPARE BUMPER devised by French inventor is spare wheel mounted forward on vertical axle to turn car away from anything bumped.

SNOW LOCUST, a British ice-and-snow remover, mounts 12 jet oil burners to melt five miles of snow per hour at 1,200°F.

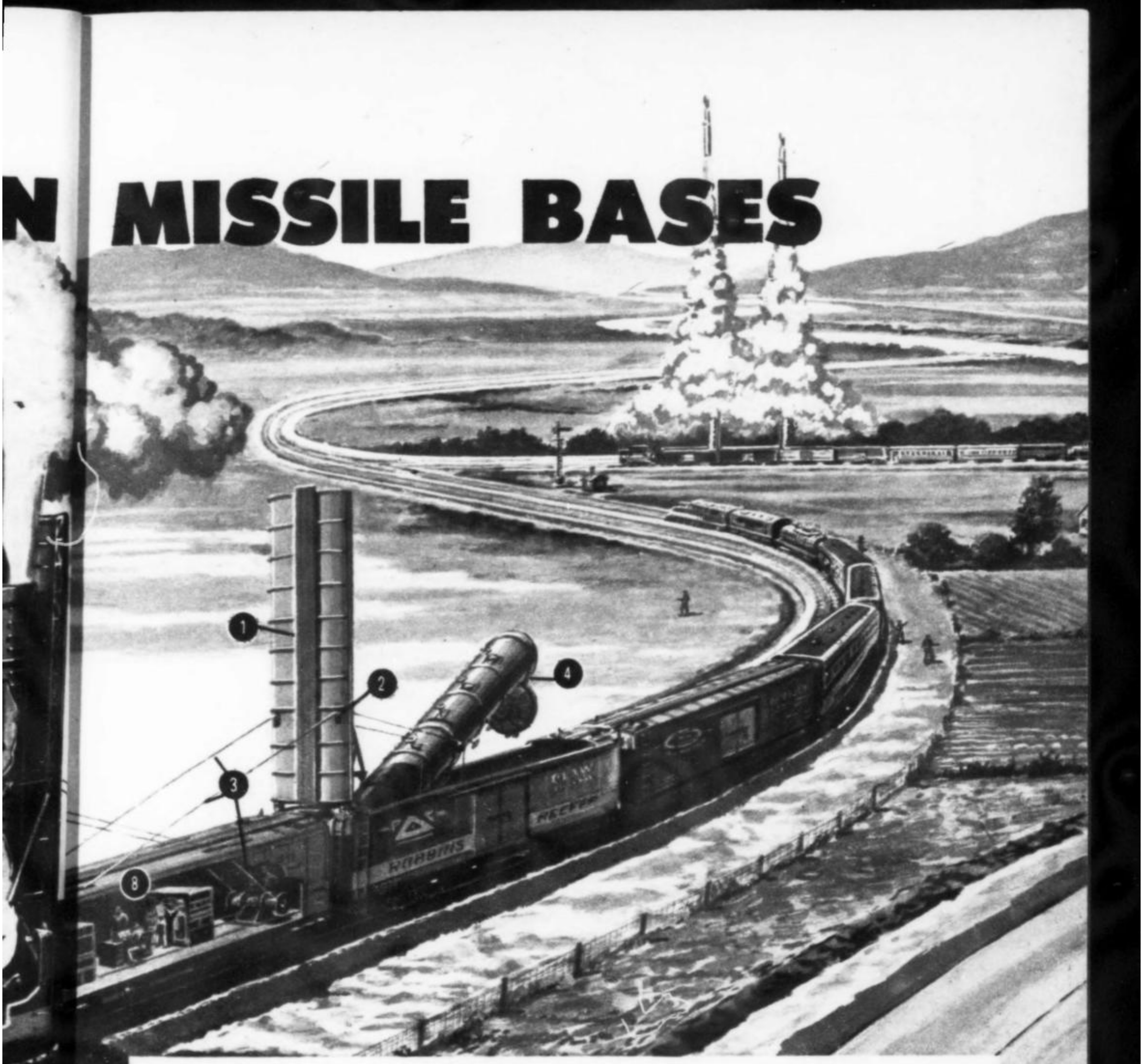
CONTINUED . . .

COMING . . .

HIT-AND-RUN

DIAGRAM of missile-base train: 1. Hinged roof of box-car is swung upward by hydraulic rams; 2. Reinforced roof, locked in vertical position, serves as gin-pole for cables elevating rocket launching tube; 3. Elevating, steadying cables operate from winches at either end of central command car, act as guy lines when the launching tubes are vertical; 4. Lid drops open as launching tube is raised to firing position on base trunnions; 5. Cutaway view of tube in firing position. Note launching stand flame deflector at bottom; 6. Buffer cylinders steady tube, help transfer launching shocks; 7. Horizontal cradles cushion rocket-carrying tube; 8. Command car instrumentation determines firing position, plots arc to target area, fires Minuteman missile.

N MISSILE BASES



An Original MI Design by FRANK TINSLEY

IT looks like any other ordinary train as it rumbles over the countryside. But if you could see through the weathered boxcar walls you'd realize that this tired-looking ten-car train is a startling hit-and-run missile base containing the most up-to-date weapons system in existence. Its purpose: to provide a mobile launching pad for the Minuteman—Uncle Sam's latest and most powerful solid-fuel missile.

MI's version of the Minuteman train differs materially from those previously published. The original concept of an undisguised missile launcher, mounted on a flatcar, is now outmoded. It is now considered essential to house the bird's propellant charge and delicate mechanisms in a shock-absorbent, air-conditioned container. This lengthens its storage life and enables it to operate instantly, [*Continued on page* 165]

in the rut you're in. Start taking the steps that will move you up and out of your Slough of Despond. There is experienced help at hand—go take it. There are people and jobs that need the man you really are. Quit hiding from them. •

Coming... Missile Bases

[*Continued from page* 67]

regardless of Arctic snow or desert heat.

The design in the illustration represents a combination of the latest ideas in Minuteman firing and support equipment, housed in what looks like a standard reefer boxcar. The roof mechanism, telescoping the functions of weather protection, launcher hoisting gin-poles and flashguard, is original with MI. So is the combination of an airtight traveling container and launching tube and the arrangement of the three-car firing unit.

MI's ten-car train is disguised as a nondescript local. It consists of a Diesel locomotive, a tank car carrying reserve fuel for increased range and a mail car used as a forward guard station. Following these come two day coaches, fitted inside as a comfortable sleeper and a diner/lounge, and a refrigerator car for food and supplies. The train's armament section includes two missile cars with a command/hoist car coupled between. A standard caboose winds up the procession and functions as a rear guard car. During action drills or actual firing, guards fan out from the train to provide a protective screen. They wear railroadmen's garb and carry sub-machine guns camouflaged as tool cases. If experience indicates the need, a second missile section can be added to the train, giving it a battery of four ICBMs.

The Minuteman missile, now approaching production, is a three-stage rocket with an atomic warhead. Approximately 57 feet from nose cone to nozzles, its largest diameter is six and one-half feet and it weighs in the neighborhood of 65,000 pounds. Its range has been estimated at 5,500 miles. The Minuteman will be loaded with a solid-fuel propellant which eliminates the intricate plumbing and lengthy countdown procedure of liquid-fuel rockets. It permits long storage in the

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"ready" state and instantaneous firing. Ready for service in 1962, the railborne Minuteman and submarine Polaris team will give the United States a powerful voice in its constant crusade for peace. •

Blows Up Buildings

[*Continued from page* 99]

out in a hurry? Jack's your man—and he's able to set off his dynamite right in the factory without disturbing any nearby equipment. Got a harbor you want cleared? Burnbrae will send you a crew complete with a diver to cut off obstructions at any depth you specify.

That's the custom blaster: an outfit that's on call to any part of the country to handle any kind of work that can be done better with explosives.

An informed estimate has it that less than two dozen firms are engaged in custom dynamiting in the U. S., about six of them on the east coast. Of these, Burnbrae, Inc., is the only outfit known to drop major urban buildings in one shot.

The secret of the building demolition is that every one of the 200 or more charges is planted in the basement according to a carefully engineered diagram. These charges, of 40 per cent strength blasting gelatin in 1¼-inch diameter sticks, ½ lb. each, are primed with a series of millisecond-delay (MS) electric caps that fire specific groups of the charges in their proper order. Now a millisecond is a very brief time span. When Jack's charges go off, they sound like a single rolling explosion to the uninitiated observer but what really happens is worth a brief explanation.

As the twin buttons on the blasting machine are depressed, the instantaneous charges placed in the foot of the wall columns fire. This undercuts the building's walls on the inside, preparing them to hinge toward the center of the structure. A split second later, the MS-25 group shatters the columns in the middle of the basement. Twenty-five milliseconds after that, the MS-50s knock out another group of columns in a concentric circle around the already shattered center. Then the MS-75s chop off the columns in a rough circle around the MS-50 loading. The firings then fan outward in widening circles to the already undercut walls.

The center of the building begins to collapse straight downward before the last of the concentric groupings fires. By the time the last charges go off, the central mass is plunging into the basement, whipping the walls inward. The collapsing structure actually folds in upon itself. "Its own falling weight does the real work," Jack says. "The dynamite just starts it. In fact, we don't use much explosive. One man can carry all we need to knock down most buildings."

Jack's eight-story Washington buildings were the optimum size for dynamiting. In Pittsburgh, he was assigned a building of only four floors, and that worried him. "I wasn't sure that it had enough weight to fall the way we wanted it to," he says. But his active imagination solved the problem. The roof drains were blocked and the fire department pumped six inches of water atop the building at Jack's request. When the firing buttons were pushed, the heavily weighted building crunched down like a tired and soggy elephant. Not a brick fell more than 30 feet from the structure's limits.

Why use explosives to fell buildings when the wrecking ball has been standard for years? Dynamite demolition is an almost fantastic timesaver. On the three-building Washington job, Jack saved the prime contractor a good 45 days of his estimated schedule. It lopped $55,000 off the estimated demolition expense.

Still more dramatic is the elimination of personal risk. Says an insurance representative familiar with demolition coverage: "If that work had been done by conventional methods—jackhammers and headache ball—there would have been at least 20 men carted off to the aid station and possibly one killed."

Clearance is the big problem to the dynamiter. It is not practical to blast buildings immediately adjacent to or touching buildings to be saved. But given 50 feet or so between moderate sized structures, the dynamiter can begin planning.

Ask Jack a technical question about his work and you'll get a full answer. Some of his friends think this is a mistake, that giving out details helps competitors.

THE EASY WAY TO START YOUR OWN BUSINESS

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THE HOW-TO-DO MAGAZINE

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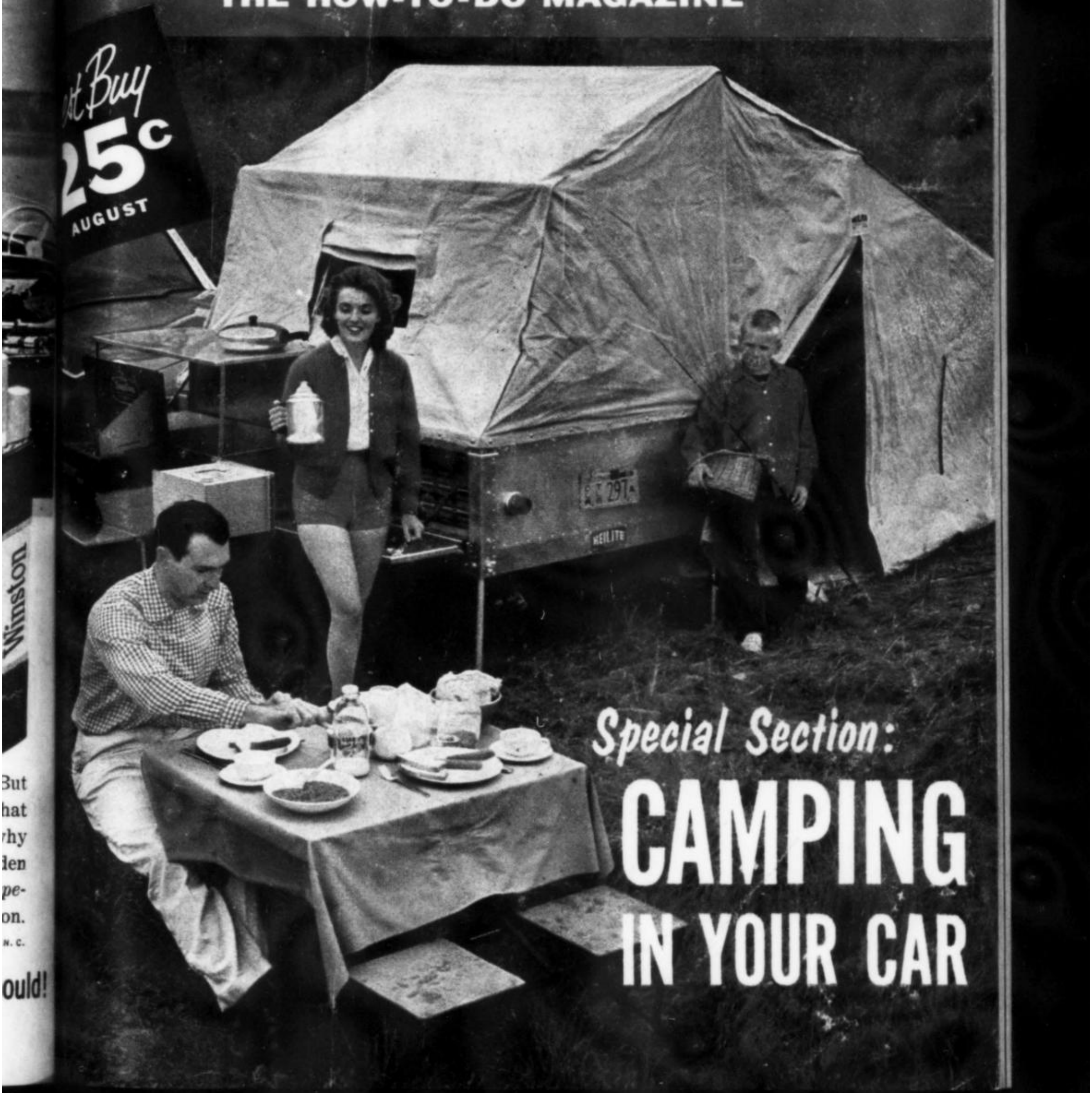

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AUGUST, 1960

Volume 56, Number 8

THE

E MIGHTY BULLDOZER

ON Thanksgiving Day 1904, in a soupy, swampy field near Stockton, Calif., a group of overshoe-clad farmers waited skeptically for the demonstration of a new type of farm tractor. They were particularly skeptical as they looked down and saw the sticky mud oozing up over the tops of their boots.

Presently, a cumbersome, slow-moving monster spouting great jets of steam heaved into view at the edge of the field and clanked to a stop. A crew of men immediately swarmed over it, removed its iron wheels and replaced them with broad crawler tracks. The machine was labeled the Holt Steam Traction Engine No. 77, after its local inventor and builder, Ben Holt. It was about to make history.

The men quickly hooked the heaving, pulsating giant to four gangs of plows and the driver took off across the field. The plows bit deeply into the quagmire and the crowd confidently expected to see the machine

RACING THEIR ENGINES, the drivers headed the crawlers for the cliff and jumped. Tractors tumbled down, were then driven under their own power at the bottom.

AIRBORNE crawlers have been parachuted into battle areas and to advance Antarctic bases; they have worked in every climate from the South Pole to Death Valley.

plow itself under in the slippery goo. Instead, it moved easily over the mush. The demonstration was an unprecedented success as the "Holt 77" pulled more plows deeper than any other tractor of the time—and its tracks hardly marked the mud.

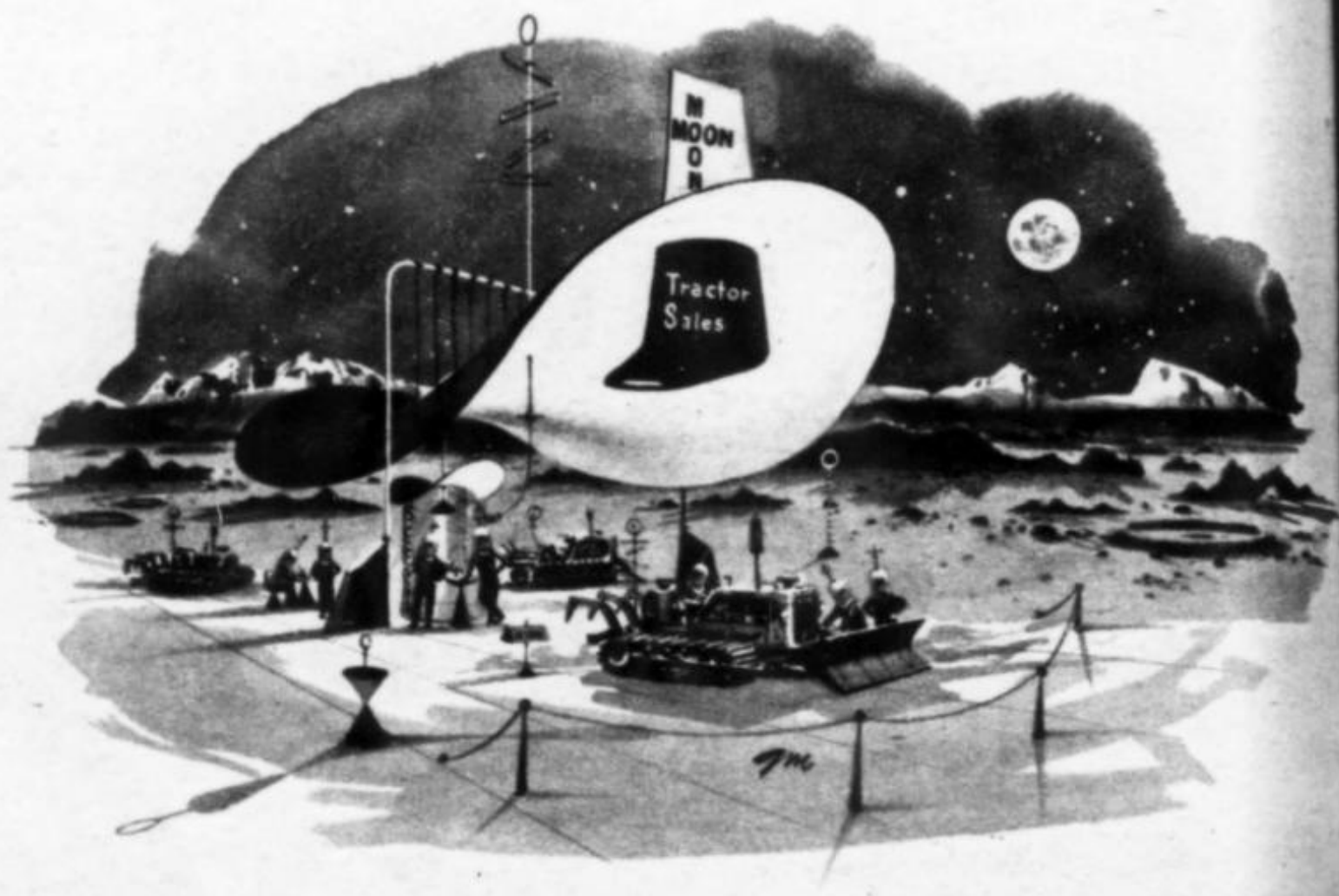
To the farmer, the new machine was a godsend. It soon found wide and welcome use in the spongy crop-fields of California. The broad, long tracks spread the weight of the machine until it exerted far less ground pressure per square inch than a walking man. The steel grousers mounted on the tracks could bite into soft, muddy earth, virtually locking the machine to the ground and permitting all of its power to be used in pulling.

The modern bulldozer is a far cry from Holt's original model. The largest crawler tractor of today weighs in at over 60,000 lbs, and can pull enough board feet of lumber out of the woods in a single trip to build a five-room house. On earthmoving jobs, crawlers can pull 50-ton loads of earth.

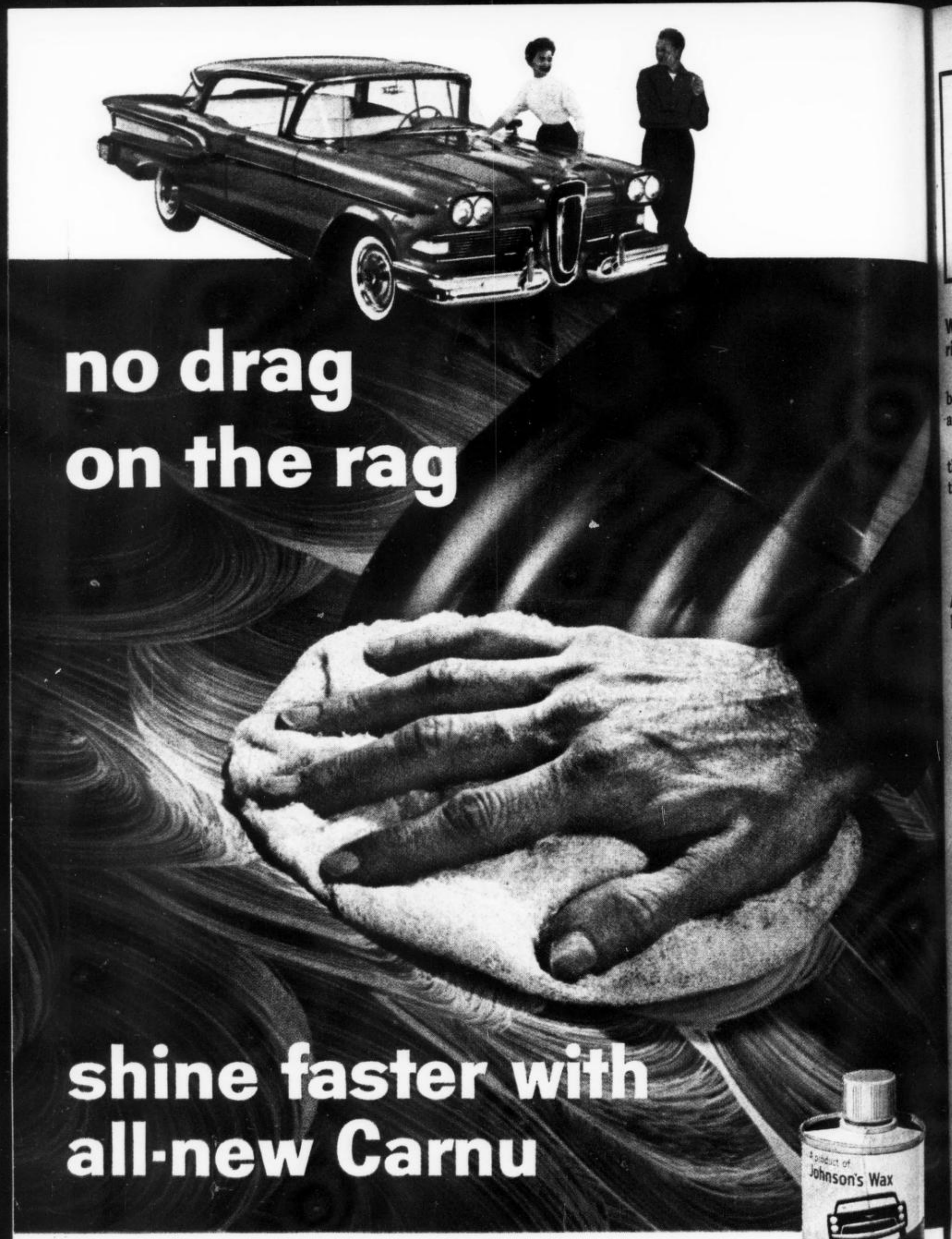
Last year over $445 million worth of crawlers were sold by American manufacturers, most of them by Caterpillar Tractor Co., a direct descendant of the firm founded by Ben Holt.

At Caterpillar, earth moving engineers claim there are few jobs of pushing or pulling that a crawler can't do.

Recently, in Canada, the collision of a fast-moving freight train with a standing freight [*Continued on page* 155]



MOONSIDE franchise was given to a Caterpillar dealer who asked for it right after Russians put Sputnik into its orbit.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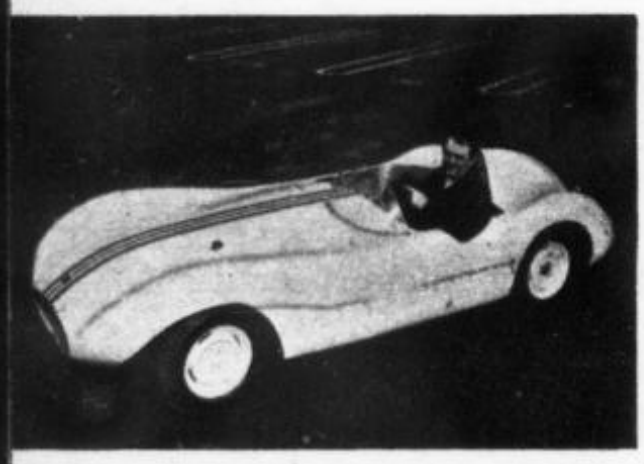

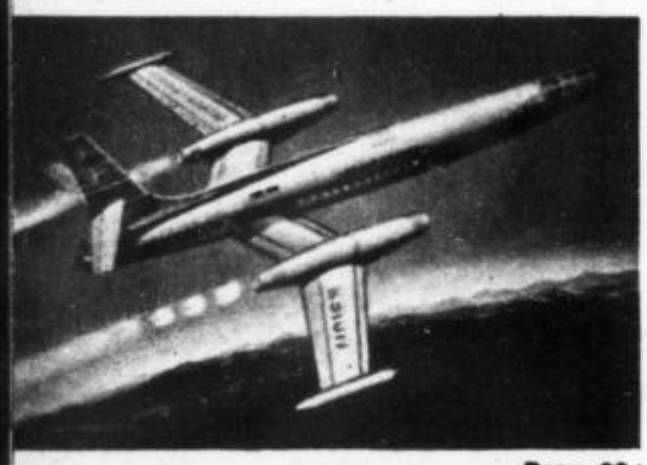

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AROUND THE WORLD IN
TRANS-EARTH
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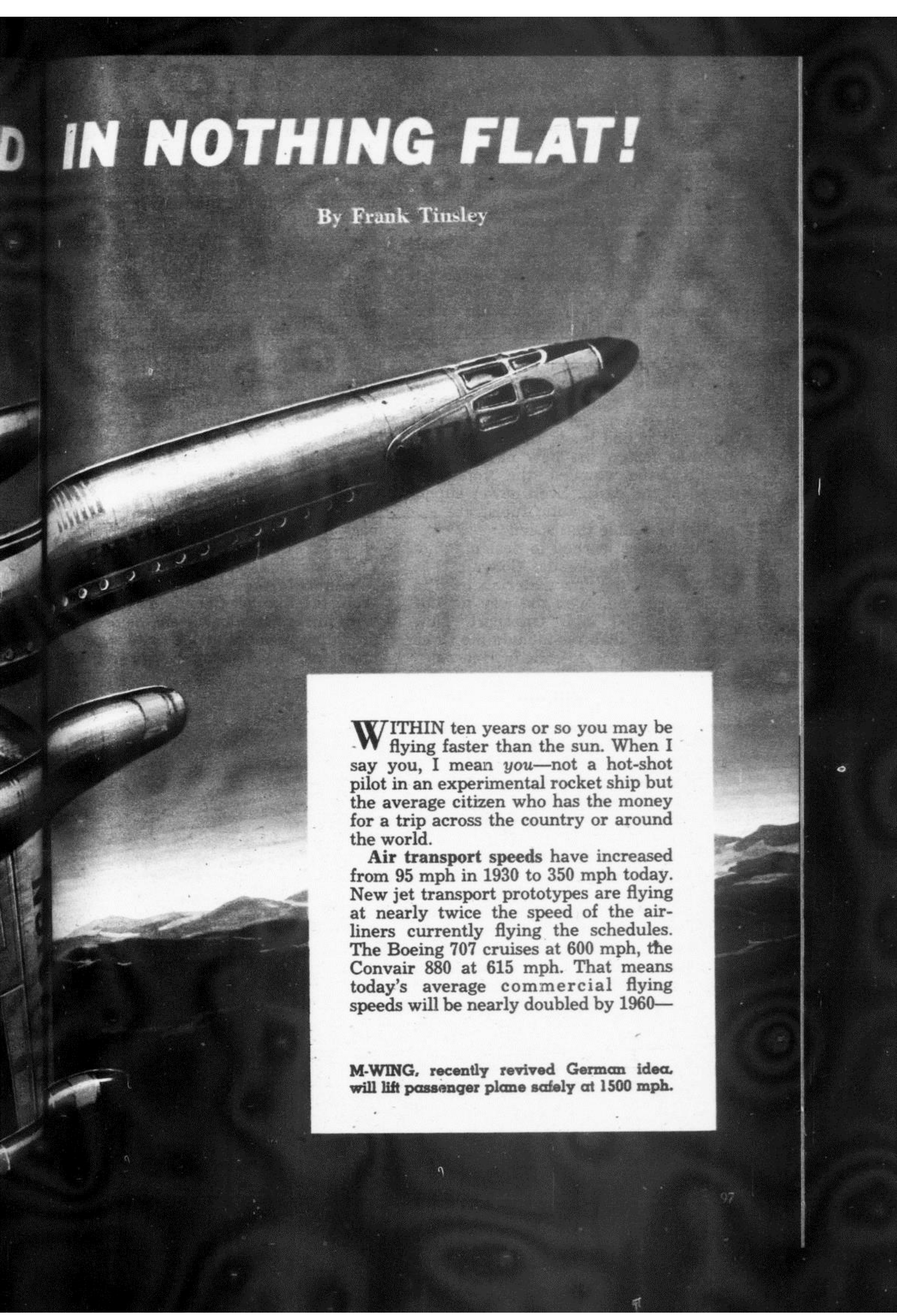
D IN NOTHING FLAT!

By Frank Tinsley



WITHIN ten years or so you may be flying faster than the sun. When I say you, I mean *you*—not a hot-shot pilot in an experimental rocket ship but the average citizen who has the money for a trip across the country or around the world.

Air transport speeds have increased from 95 mph in 1930 to 350 mph today. New jet transport prototypes are flying at nearly twice the speed of the air-liners currently flying the schedules. The Boeing 707 cruises at 600 mph, the Convair 880 at 615 mph. That means today's average commercial flying speeds will be nearly doubled by 1960—

M-WING, recently revived German idea, will lift passenger plane safely at 1500 mph.

in one big jump. And we can see very clearly what will follow from what has already been done in the field of military aviation.

Transport planes follow the design advances proven in fighters and bombers. The turbo-jet transports of tomorrow will be, in effect, today's proven B-47 and B-52 jet bombers converted to the uses of civil aviation. So we can tell from the most advanced military experimental planes of today what to expect in commercial flying ten years from now.

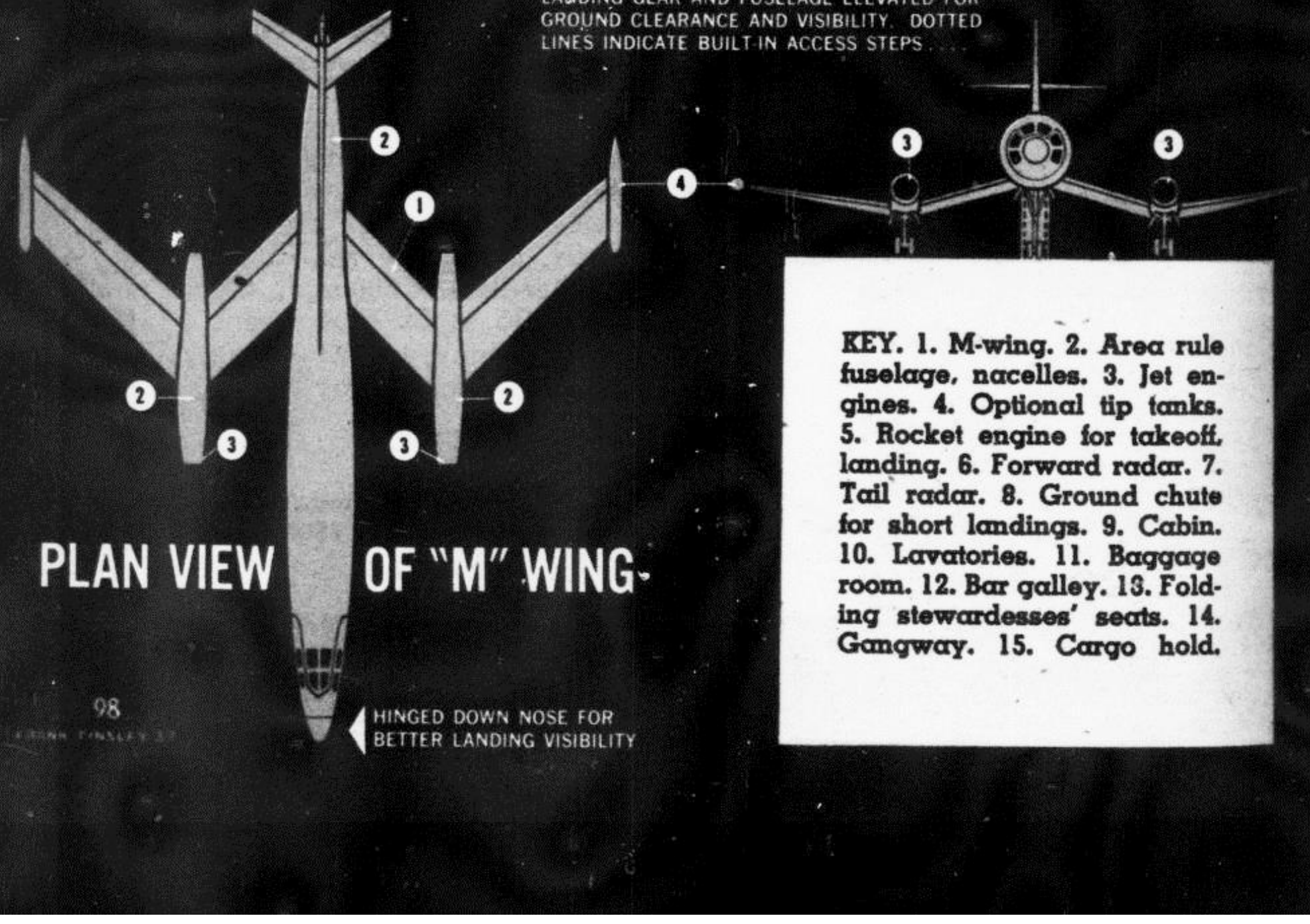
One of the latest military meteors, the Chance Vought "Crusader," recently raced from Los Angeles to New York in just under three and a half hours. If it had made the hop just 24 minutes faster, the new navy fighter would have equaled the rotational speed of the earth. Even newer supersonic jets, using exotic fuels, are expected to double that speed.

The lessons learned in designing advanced aircraft like the Convair B-58 Hustler, and the new materials used in its construction, open the way for our M-wing, 1,500 mph transport. New aerodynamic features include the Coke bottle shape (the so-called "area rule" design) that permits a freer flow of air over the wing root and reduces drag. To combat the enormous heat caused by skin friction at supersonic speeds, the needle noses of today's planes and missiles are being blunted. It has been found that the increased area of a pot-bellied nose cone diffuses the heat and dissipates it more easily.

At speeds around 1,200 mph the flat glass panes of conventional windshields would melt. To meet this problem, Boeing has patented a hinged nose section like the movable visor of a knight's helmet. Raised to the flight position, it provides a perfectly streamlined shape with top and side windows for pilot visibility. When the speed is reduced, the nose swings down to uncover a standard windshield that permits ample forward vision for take-offs and landings.

A major design innovation is the M-wing, originally tested by the Germans back in the early 1940s and revived by our own NACA research labs in 1948. The basic idea back of this new form is to eliminate the bending and twisting problems that plague the swept wing. With husky Coke bottle engine nacelles providing anchors at the critical panel junctions, the M-wing has proven su-

FRONT VIEW SHOWING "CRANKED" WING, SHORT LANDING GEAR AND FUSELAGE ELEVATED FOR GROUND CLEARANCE AND VISIBILITY. DOTTED LINES INDICATE BUILT-IN ACCESS STEPS



PLAN VIEW OF "M" WING

KEY. 1. M-wing. 2. Area rule fuselage, nacelles. 3. Jet engines. 4. Optional tip tanks. 5. Rocket engine for takeoff, landing. 6. Forward radar. 7. Tail radar. 8. Ground chute for short landings. 9. Cabin. 10. Lavatories. 11. Baggage room. 12. Bar galley. 13. Folding stewardesses' seats. 14. Gangway. 15. Cargo hold.

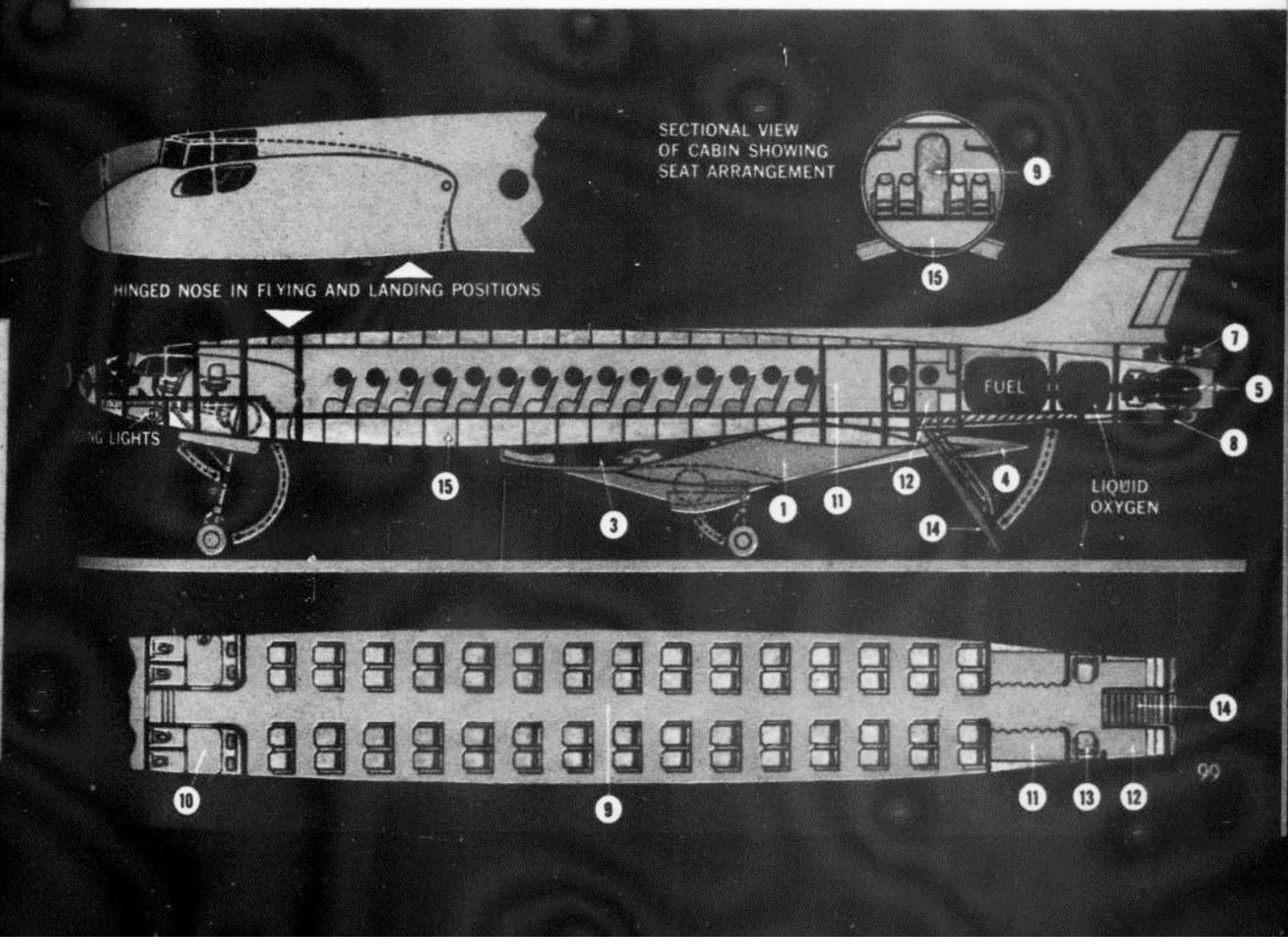
perior at supersonic speeds to the swept and delta forms.

New methods and materials are gradually being evolved to lick the stresses and thermal problems of Mach-2 flight. Honeycomb structures, fabricated of Armco's PH-15-7-Mo stainless steel, retain their strength and form at temperatures up to 1,000° F—the frictional heat whipped up at 2,720 mph. Pyroceram, a new basic material developed by Corning Glass, maintains its rigidity at 2,200° F. This means that Pyroceram nose cones, fins and leading edges, can punch through the thermal thicket at speeds in excess of 5,000 miles an hour.

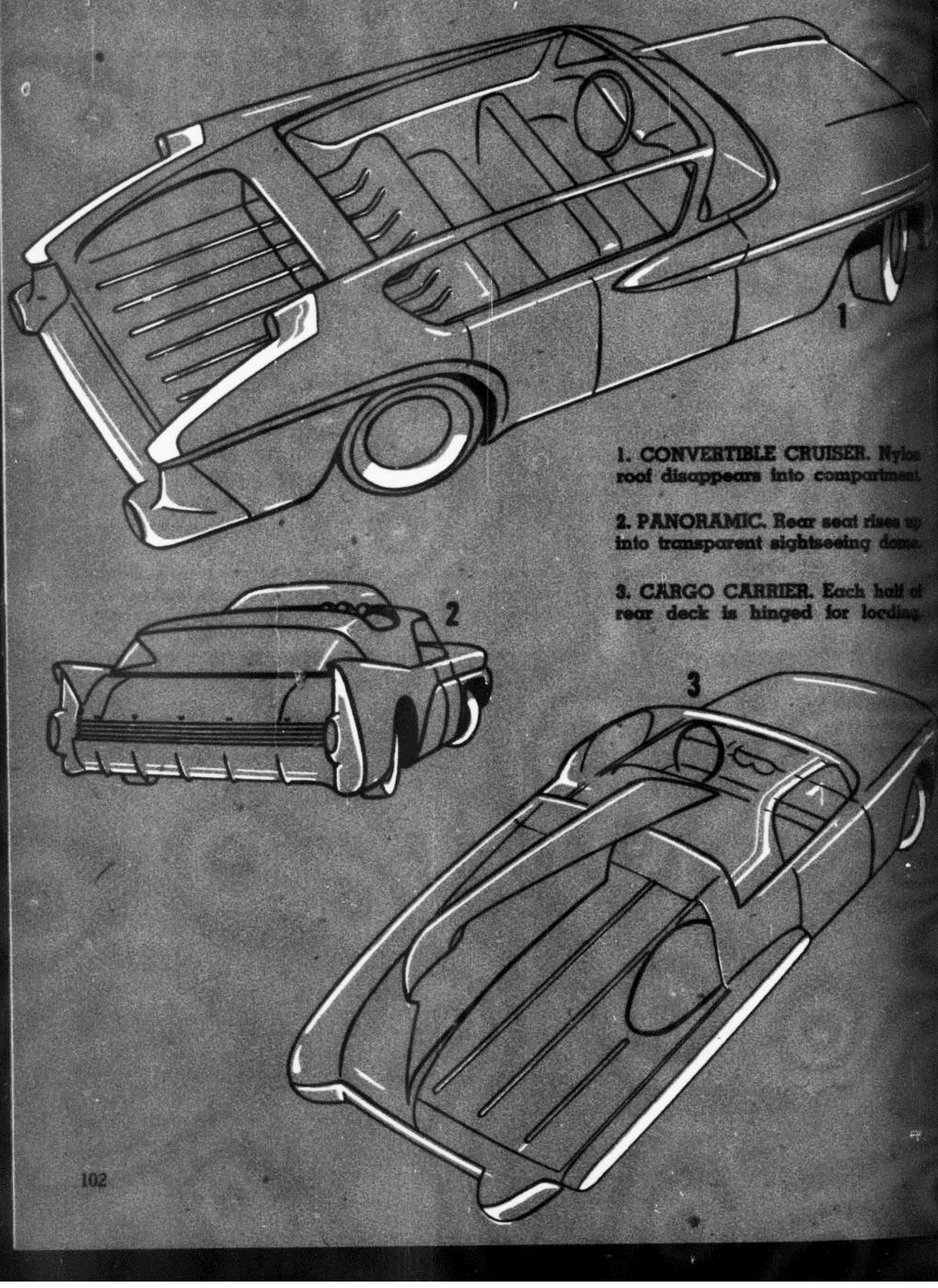
The twin jet engines of MI's transport have noise suppressors and jet reversers for short, quiet ground runs and are set high so that the wing structure is uninterrupted. Mounted beneath the spars, dual landing wheels fold smoothly into the nacelle bottoms. For faster take-off and climb and for emergency booster use, a four-burner rocket engine nestles in the transport's tail.

The MI transport holds 60 passengers —small by present standards. Its size is based on the theory that faster, more frequent runs with lighter loads and minimum crews and equipment, provide more efficient and economical service. With almost any destination on earth less than two hours away, elaborate meals or sleeping facilities become unnecessary. Flying faster than the sun poses some odd problems in travel. Two entirely different schedules are involved—clock time and "stomach time." On a westbound run from New York for instance, the passenger can enjoy a solid airport breakfast before leaving on the 9 a.m. flight. Even allowing for a couple of stops en route, our MI clipper paces old Sol through four time zones, arriving at San Francisco to find the clock's hands still at 9 a.m. He has crossed the country in no time and his stomach tells him that lunch time is only an hour away!

Traveling eastward from San Francisco around the world is even more fantastic. On this run our passenger is doubling the sun's time. If he leaves early in the morning and follows established air routes, he will spend 14 hours in flight but will run through 28 hours of time zones and will see the sun rise twice. Our MI voyager will eat only four meals, landing back in Frisco after his second breakfast! •



Station Wagons of



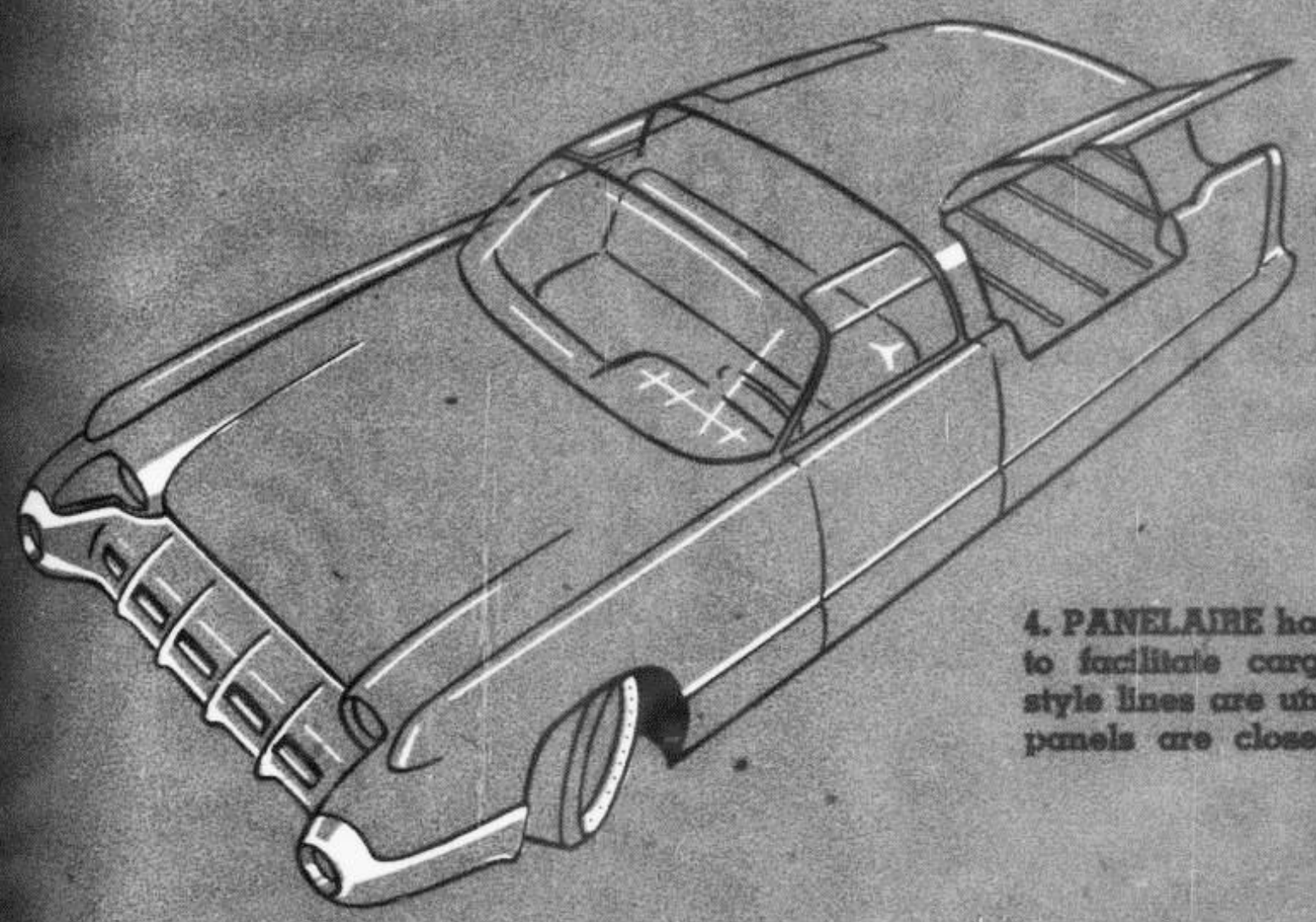
1. CONVERTIBLE CRUISER. Nylon roof disappears into compartment.

2. PANORAMIC. Rear seat rises up into transparent sightseeing dome.

3. CARGO CARRIER. Each half of rear deck is hinged for loading.

s of Tomorrow

THE current and ever-mounting interest in station wagons has reached a point where Detroit expects to sell a million of them in 1958. Tailored with sedan-like looks and featuring hot performance to help hypo their sales, the wagons of tomorrow—now on the drawing boards—promise to [Continued on page 185]



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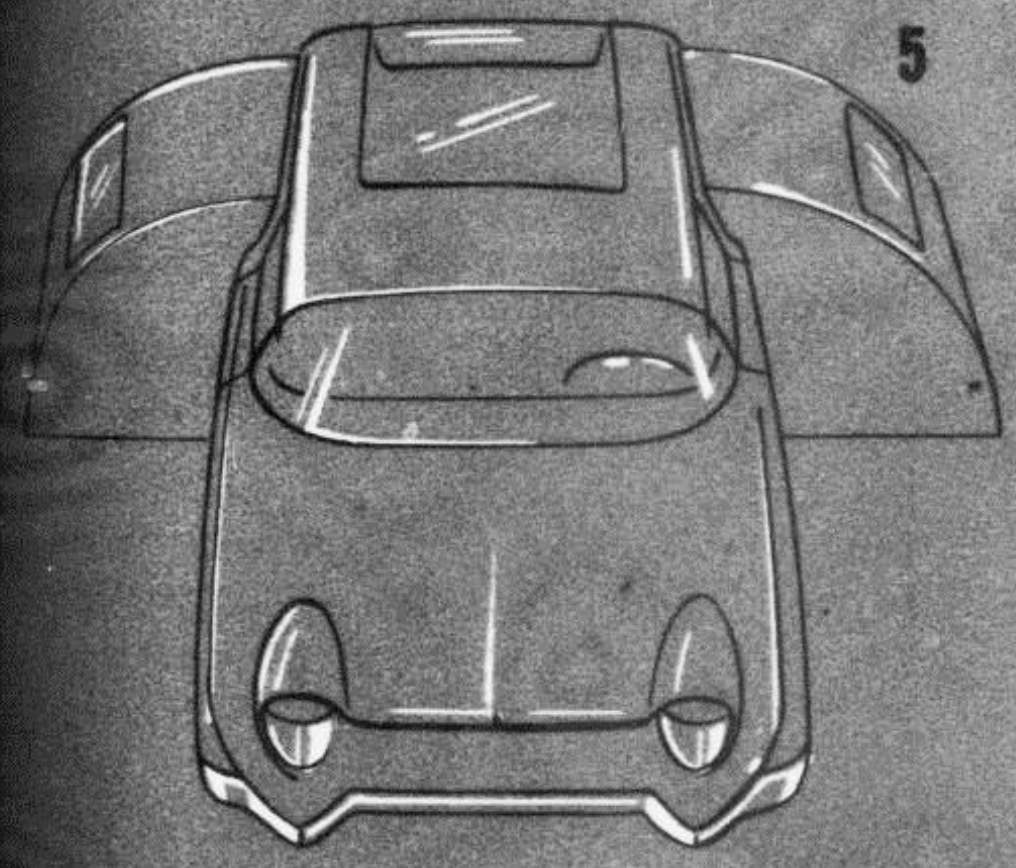
4. PANELAIRE has wing-type panels to facilitate cargo handling. Body style lines are unbroken when wing panels are closed. Glass is tinted.

5. VACATIONER. Twin canvas enclosures unfold outward to provide sleeping quarters for four. **6. TOURIST** has hinged rear unit which includes fender-halfs, deck, rear window to utilize maximum width for storage.



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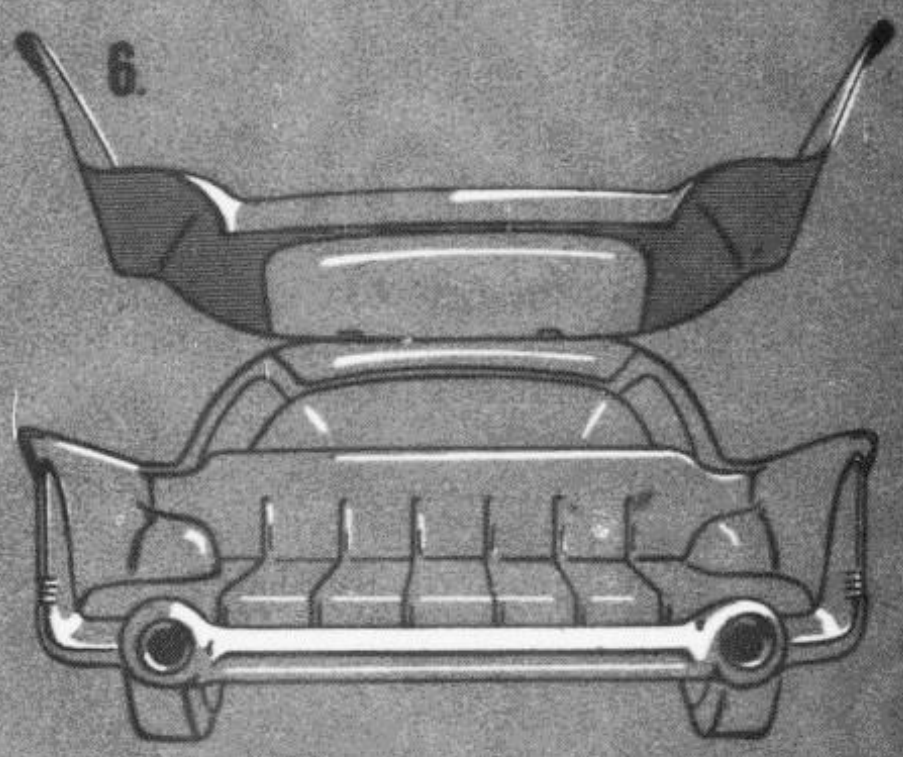

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THE HOW-TO-DO MAGAZINE

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APRIL

Compo-drawing of
THE LINCOLN CONTINENTAL
Ford's Sensational New Luxury Car

Special Section! BOATS YOU CAN BUILD YOURSELF

MECHANIX ILLUSTRATED

A F A W C E T T P U B L I C A T I O N

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VOLUME 51, NUMBER 4

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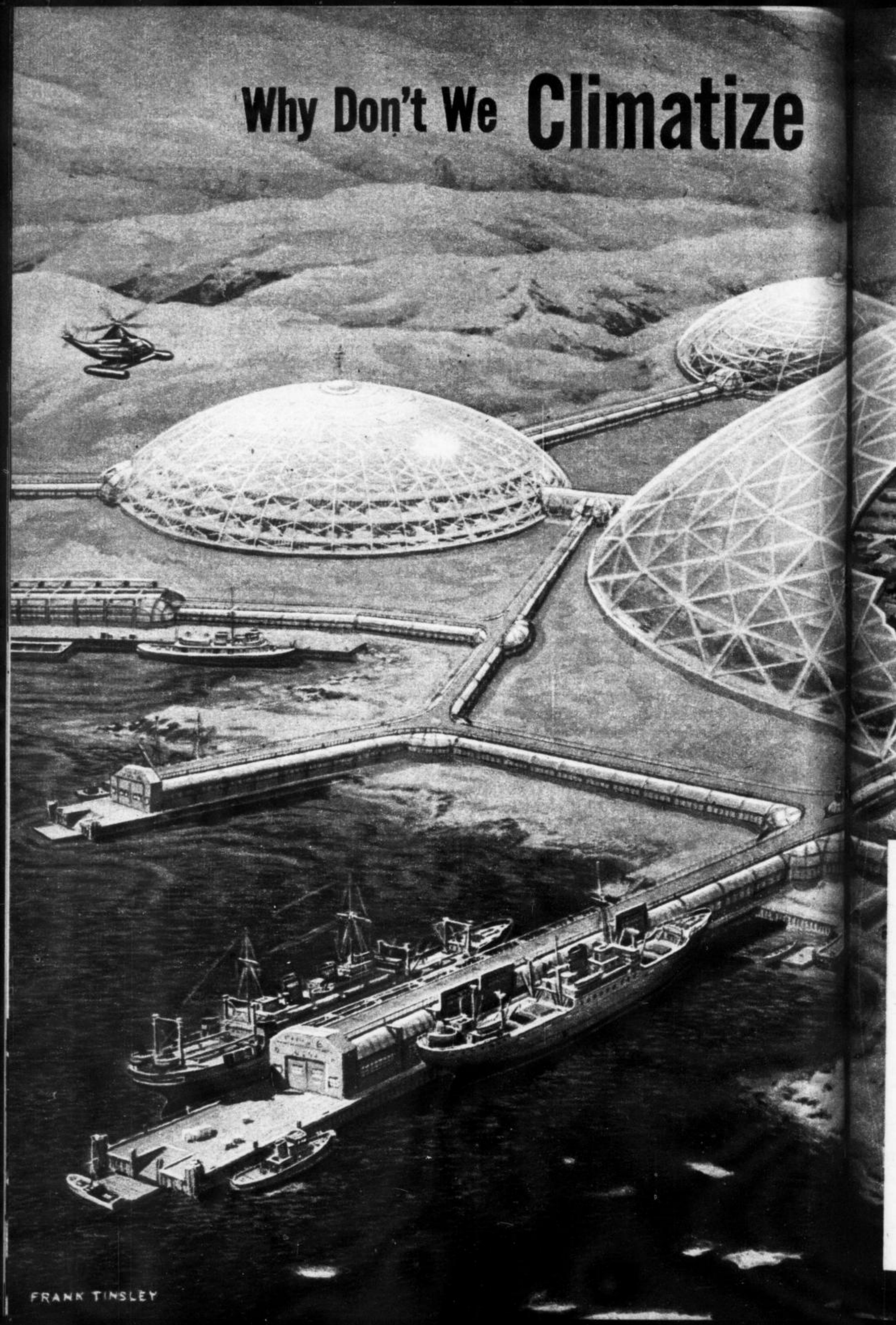
Why Don't We Climatize



FRANK TINSLEY

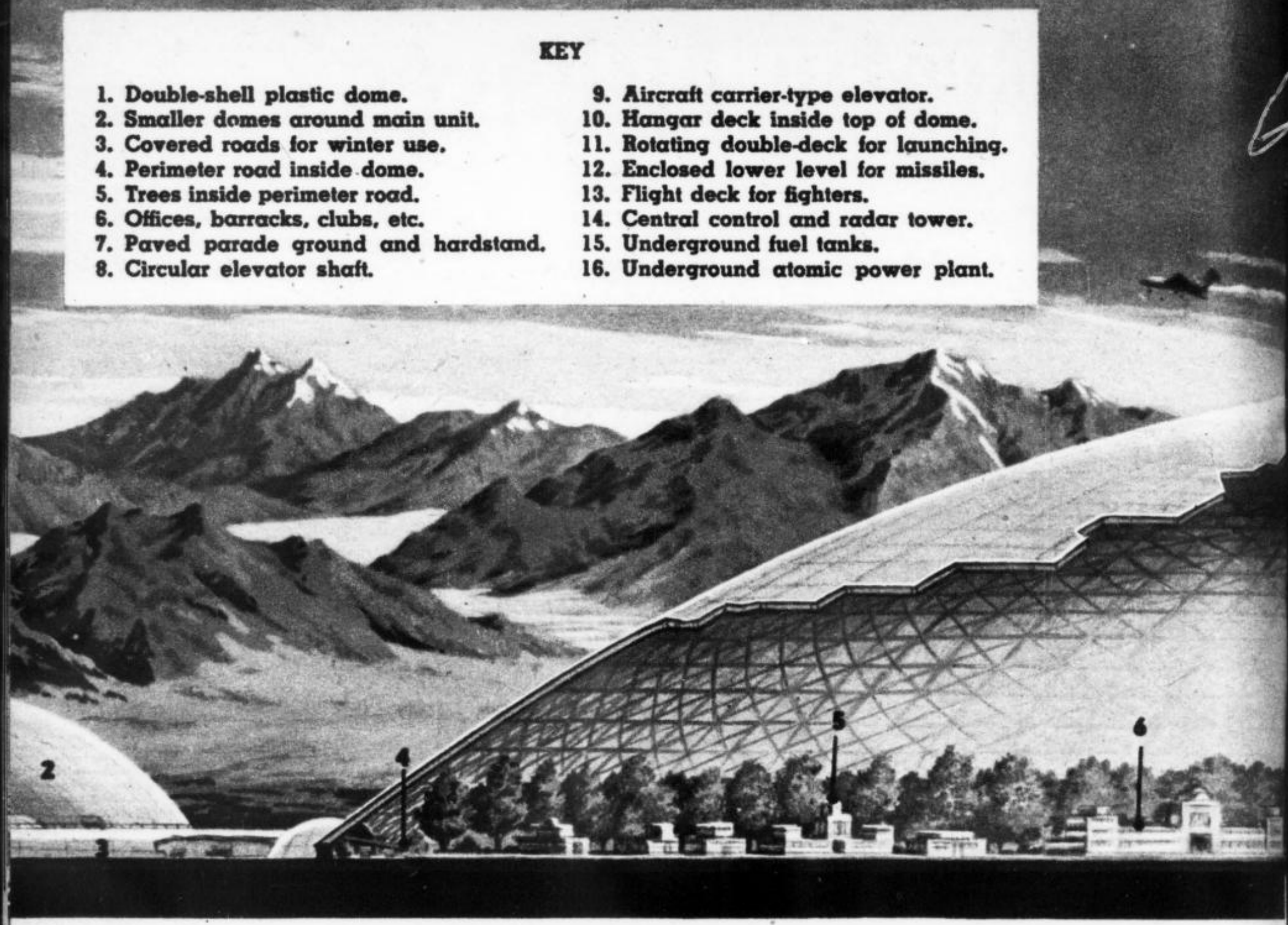
Our Arctic Airbases?

A huge plastic dome, heated by A-power, may answer the problems of our polar outposts.

By Frank Tinsley

THE atomic power plant has at last reached the stage of operational practicality. Proof of this is the Pentagon's recent call for private industrial bids on the production of transportable fission units, designed to generate steam and electricity at remote military bases of our far-flung defense chain. Dubbed the Army Package Power Reactor, this compact, 1,700-kilowatt nuclear plant can be broken down and airlifted piece by piece to U. S. bases overseas.

This move by the military is not to imply that the present A-power models have reached an efficiency level where they can compete economically with coal, oil or water-power generators. It simply means that the Pentagon planning brains believe that in arid areas, where natural fuel is nonexistent, the atomic plant offers a cheaper, more independent power source than conventional fuels. Once

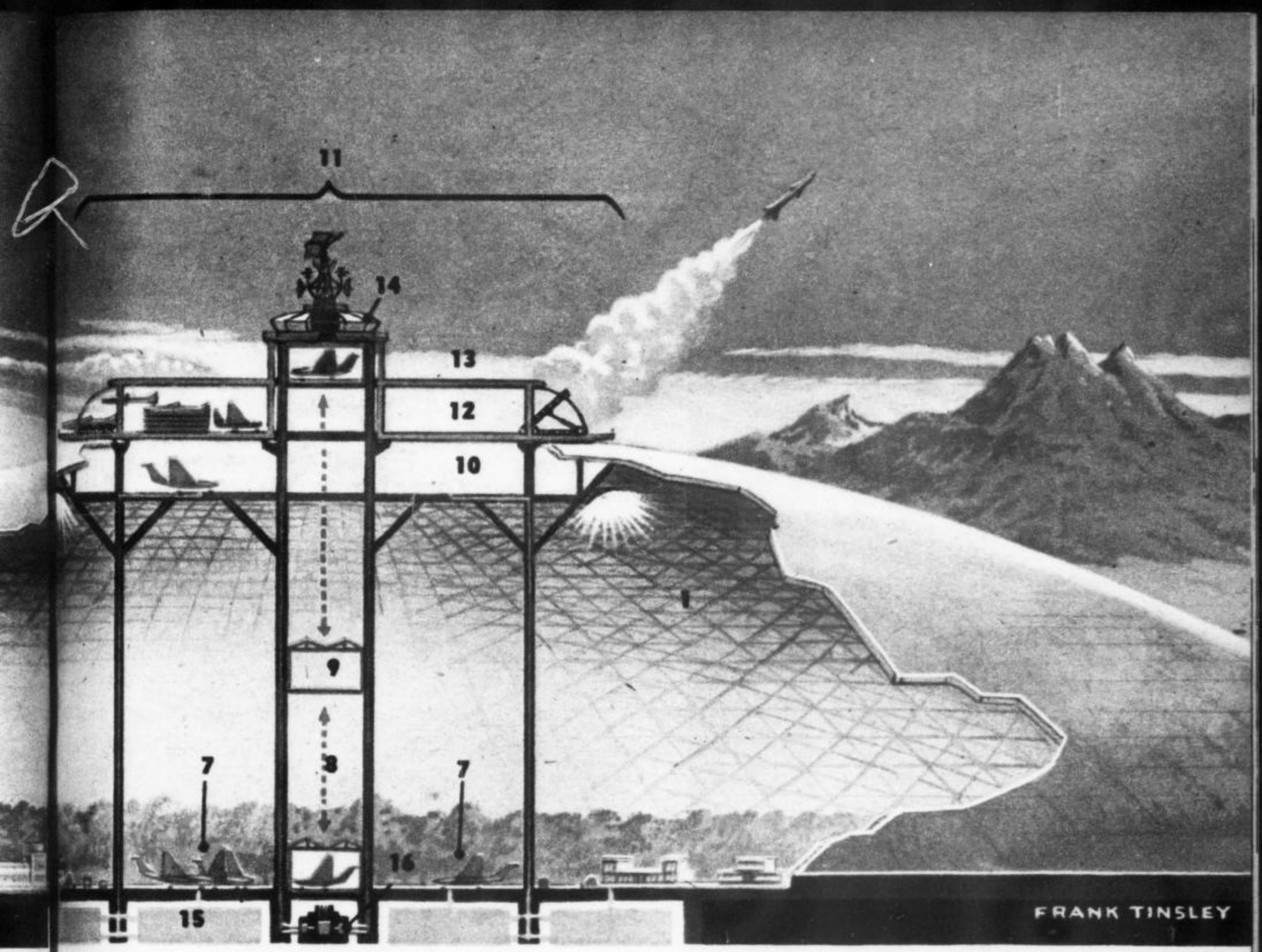


erected, especially if underground, it provides a practically permanent, almost indestructible font of heat and power which eases the present logistical strain of seaborne fuel supply.

This harnessing of atomic energy can be far more than just a substitute power source. If fully exploited, it may well usher in a whole new era of living comfort for service men stationed in icebound polar regions and the sunbaked deserts of the Near East. Arctic bases can be warmed and tropical flying fields cooled to a degree that will make life endurable for the guardian soldier and his family. For the greatest single by-product of fission is heat in enormous quantities—heat that has been one of the chief headaches of A-bomb manufacture and which the AEC has spent millions of dollars to dissipate. Yet it is this very caloric waste product that is the key to both house heating and refrigeration. The only difficulties involved in putting it to use are the purely mechanical problems of enclosure and distribution.

Here, MI brings together two apparently unrelated branches of our recent technological development—the atomic powerplant and one of the more advanced forms of modern architecture. As an insulated enclosure is a prerequisite for any air-conditioning project, we will consider the latter first. R. Buckminster Fuller, well known inventor of ultra-modern houses, automobiles, etc., has designed a new type of military shelter for advanced base operations. It takes the form of a geodesic dome made up of easily assembled, diamond-shaped, cardboard units, reinforced and weatherproofed by an outer coating of polyester resin. Thirty-six feet in diameter and weighing only 1,250 lbs., including floor, the dome houses 30 to 40 men and can be lifted aloft and transported bodily by helicopter. It is expected to replace the present quonset huts and reinforced tents, as well as the simple field tents that have sheltered armies for centuries.

Fuller's geodesic dome is the ideal enclosure for MI's climatized airbase. It can be scaled up to almost any size and has the maximum strength-for-weight of any architectural form. Its lack of internal bends and corners makes it highly efficient for air conditioning and its smooth, streamlined exterior presents minimum wind resistance to Arctic gales. Best of all, it can be rapidly and easily erected of standardized, prefabricated units by a comparatively small



work force—an important consideration in polar housing projects.

MI's giant domes are, of course, intended as permanent installations and are a bit more complicated than the Marine field shelter. To gain maximum insulation value, they are designed with double skins like monster, curved sheets of Thermopane. If necessary, the air between the outer and inner skins can be evacuated, transforming the dome into a huge vacuum bottle. The triangular panes of transparent plastic fit into a framework of reinforced plastic box-girders which double in brass as heating or cooling ducts. Conditioned air is bled into the lower living area of the enclosure, rises to the upper sky area and is sucked out. By exposing this warmer, "used" layer to properly directed jets of cold air, or by seeding with silver iodide or dry ice, weather can be created within the top of the dome. Clouds, rain or sunny skies can be induced at will, giving the inhabitants the illusion of living out of doors in a pleasant, temperate climate.

The ground within the dome will be warmed or cooled by a subsurface grid of water pipes. In polar bases, the permafrost will be overlaid by a layer of radiant heated topsoil in which trees, shrubbery, grass, gardens or crops can be grown. This concept of a gargantuan Arctic greenhouse is also based upon long experience. For generations, steam and hot water from Iceland's volcanic springs have been used to grow flowers and vegetables all year round. Piped into Reykjavik, the capital city, this natural heat warms homes, hothouses and office buildings during the rugged Icelandic winters.

MI's polar bases will be a synthetic version of this, with a large, central living dome, surrounded by smaller domes for service facilities, storage, cultivation of fresh food, etc. The parent dome, as shown in the illustration, is 2,000 feet in diameter and contains the military installations, principal living quarters and the atomic power plant which is the hot, beating heart of the base. The latter is buried in a subterranean vault beneath the center of the dome, sheathed in concrete shielding to protect the personnel and is almost impervious to bomb damage. Above it is a large, circular area, paved with concrete and usable as a parade ground for drills and formations, or as a hardstand for reserve aircraft.

In the center of this is an open elevator shaft, leading to [*Continued on page* 193]

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MECHANIX ILLUSTRATED

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RAILROADS IN THE SKY

Complete Story of Monorails, Exciting Trains of Tomorrow

HAVE YOU LIVED BEFORE?

...Will You Live Again? Truth About Reincarnation

HOW TO GET A FREE VACATION

Travel Anywhere in the U. S. In a Brand-New Car at No Cost

Mechanix Illustrated

A FAWCETT PUBLICATION

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Volume 52, Number 7

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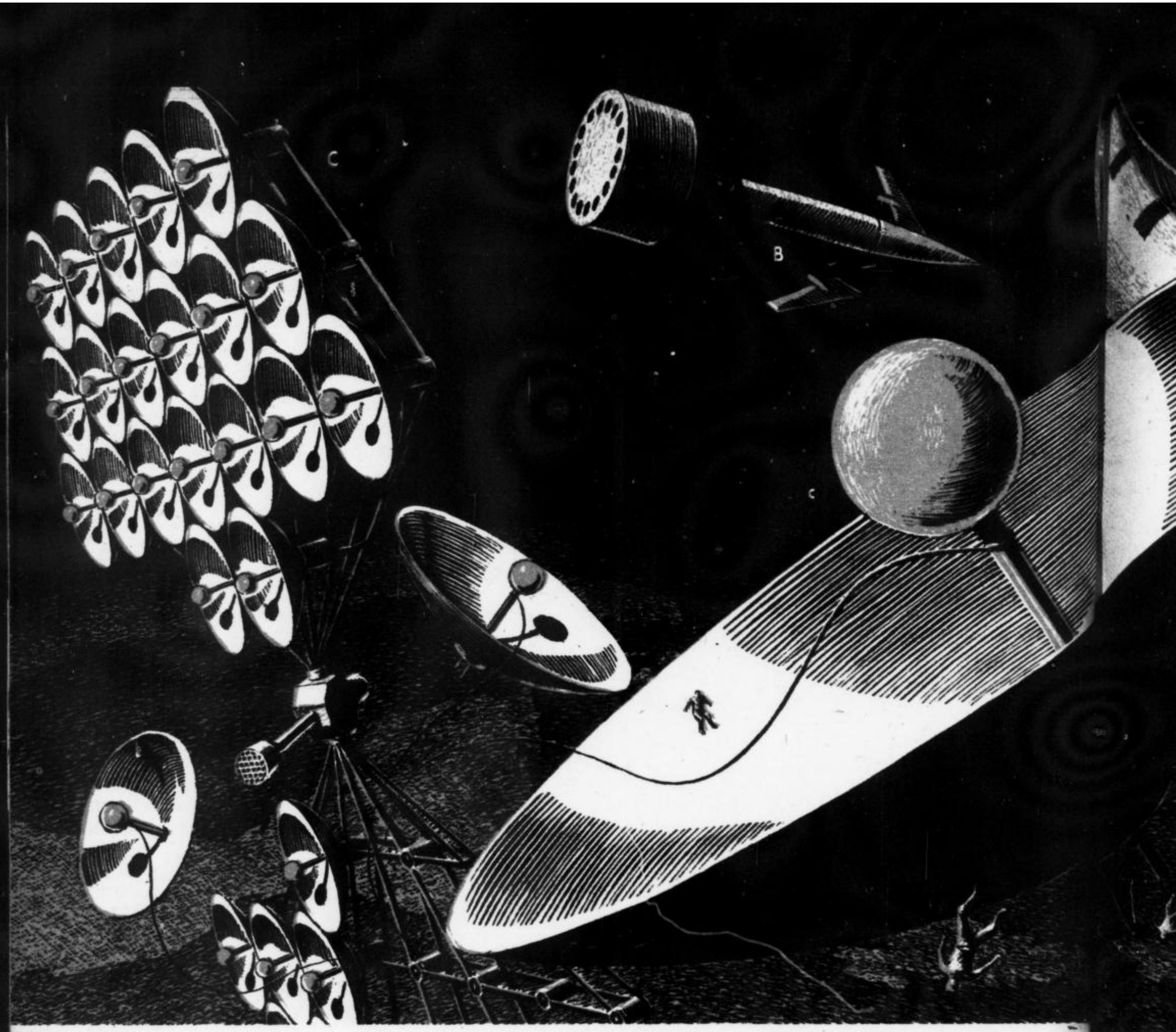


Satellites may be forerunners of Von Braun's famed space stations. A. Liquid rocket for

The Mouse

By O. O. Binder

Orbiting around the earth at the fantastic speed of 18,000 mph, the first space satellite will herald the beginning of a new era in 1957.

IN 1957 or 1958 you may glimpse a rapidly moving "star" that, contrary to all other celestial bodies, will rise in the west and set in the east, moving far faster than earth's rotation. You will see it (if you are sharp-eyed) only at dawn or dusk, and in seven brief minutes it will streak clear across the heavens from horizon to horizon. Its speed will be over 18,000 miles per hour.

This man-made star will be the first Space Satellite, dubbed the MOUSE (Minimum Orbital Unmanned Satellite Earth) by Dr. S. Fred Singer of the University of Maryland. About the size of a basketball, the MOUSE will circle the earth between 200 and 300 miles high, once every 90 minutes.

None of this is speculation anymore, of course. Since President Eisenhower's dramatic announcement last August, the U.S. Department of Defense has already signed a $2,000,000 contract with the Glenn L. Martin Co. to construct the launching vehicles. General Electric Co. has been chosen to make the rocket

lunar landings. B. Nuclear long-range space ship. C. Stuhlinger's ion-electron rockets.

That Will Change Your Life

motors. Under the code name Project Vanguard scientific personnel are already preparing for S-Day—Space Day—within two years.

Thus, each citizen of the U. S. is now investing in this new venture and paying for it via taxes. The cost of these experimental baby space stations will be comparatively low, estimated around $10,000,000 each. But at least half a dozen will be tried according to one government spokesman. Add to this all research, monitor stations, ground equipment and personnel and the cost will undoubtedly double or triple.

What will these earth satellites actually be like? How will they get up? What jobs will they do?

Best guesses, in lieu of official government data not yet released, are that each will begin as a three-stage rocket device standing 150 feet high and 30 feet wide at the base, in the shape of a tall tapering cone. The multiple rocket will be shot up from the coast, slightly tilted to go over the ocean so that when its first two stages burn out and drop off, they will fall into open sea without danger.

The final stage—the satellite itself—will reach a height of 200-plus miles, where guide rockets will then turn it into its precise orbit around the world. The entire flight will take less than one hour.

Illustrations courtesy SPERRYSCOPE. publication of Sperry Rand Corp.

We don't know yet how long it will stay up before the drag of air friction, even at those rarified heights, will slow it down and make it plunge earthward like a flaming meteor. Estimates vary from a few days to possibly two months.

Whatever its life span in space, any or all of the following automatic devices will go into operation as soon as it reaches orbital position. A gyroscope flywheel will spin and fasten it in space so that it always points a certain way, to allow fixed photos and TV pictures to be taken of the earth below. A spring will eject a long antenna for transmitting electronic signals down to a chain of monitor stations girdling the world. From the rear a hydraulic rod will push out, at the end of which is a silicon battery (recently developed by Bell Telephone) which will use direct sunlight to produce electricity and power all the instruments. In space, with no air to filter and soften the sun's powerful rays, the battery will operate at maximum efficiency, producing 12 kilowatts.

Within the satellite, a dozen or more robot instruments will be controlled by an electronic brain. Radar will scan meteors above and clouds below. Still and movie cameras will constantly photograph the world with telescopic lenses. TV will give earth the once-over from pole to pole. A Geiger counter will tabulate cosmic rays. Inferometers will measure the intensity of the sun's radiations hitting our atmosphere.

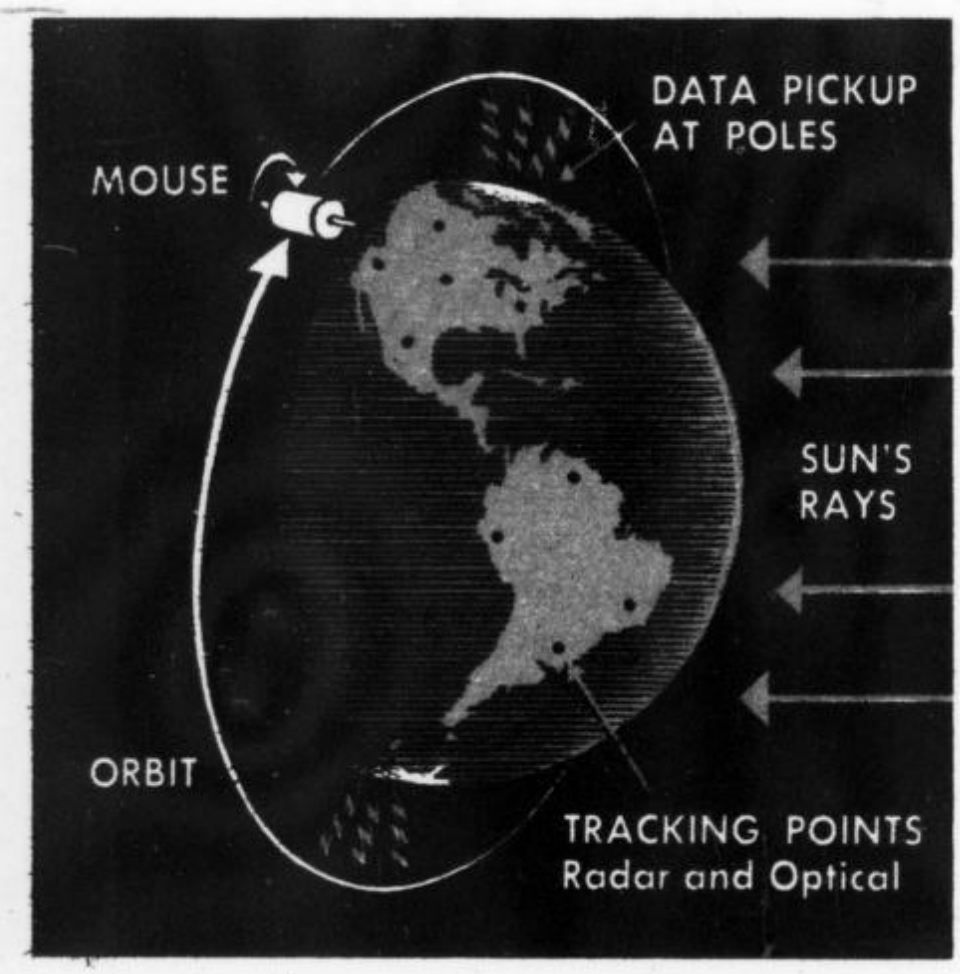
Other instruments of ingenious electronic science will be packed in, limited only by the room available. Undoubtedly, different satellites will be sent up containing different sets of devices.

All the data will be telemetered back to earth via electronic signals. Engineers have already devised a single beam that like a coaxial cable can transmit 50 different messages at the same time, including TV, radar and camera pictures. At least 20 receiving stations will be waiting, set strategically around the world at such spots as the Arctic and Antarctic, the equator, Greenland, Hawaii, and certain Atlantic and Pacific islands.

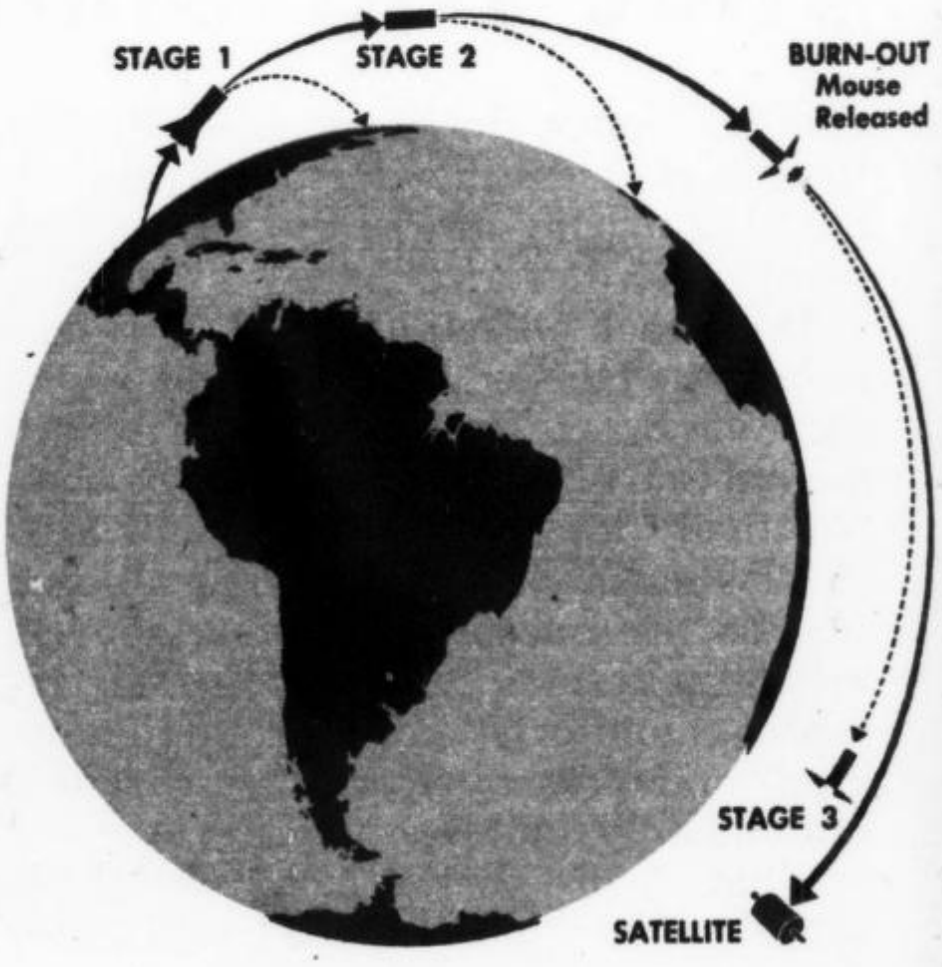
Each station will receive the signals in turn as the satellite passes over. Machine brains will decode and classify the space information for waiting scientists. Valuable knowledge that mankind could never gather otherwise will pour down and will swiftly find application in our modern world of technology.

Today we have a radar network around our coasts and extending beyond our borders into the Arctic circle to

Gyro spin keeps MOUSE at fixed altitude, holds instrument, battery toward the sun.



After burnout, last rocket's nose releases stabilized spinning drum at right altitude.



warn us of approaching enemy craft. But limited by the horizon, ground radar systems cannot see more than 18,000 miles or three bomber hours away.

From the space satellite 200 miles high, radar will have no limiting horizon at all. It will spot enemy bombers anywhere on earth the moment they take off.

Scientists say that the all-seeing radar space satellite (set up permanently someday in a higher orbit) will make sneak attacks impossible. Space radar will also track the much-dreaded intercontinental guided missile. Thus, it is wholly within the bounds of reason that with all attack plans immediately exposed by space radar, war will finally become an obvious stalemate—even before it starts.

But that's only the beginning. . .

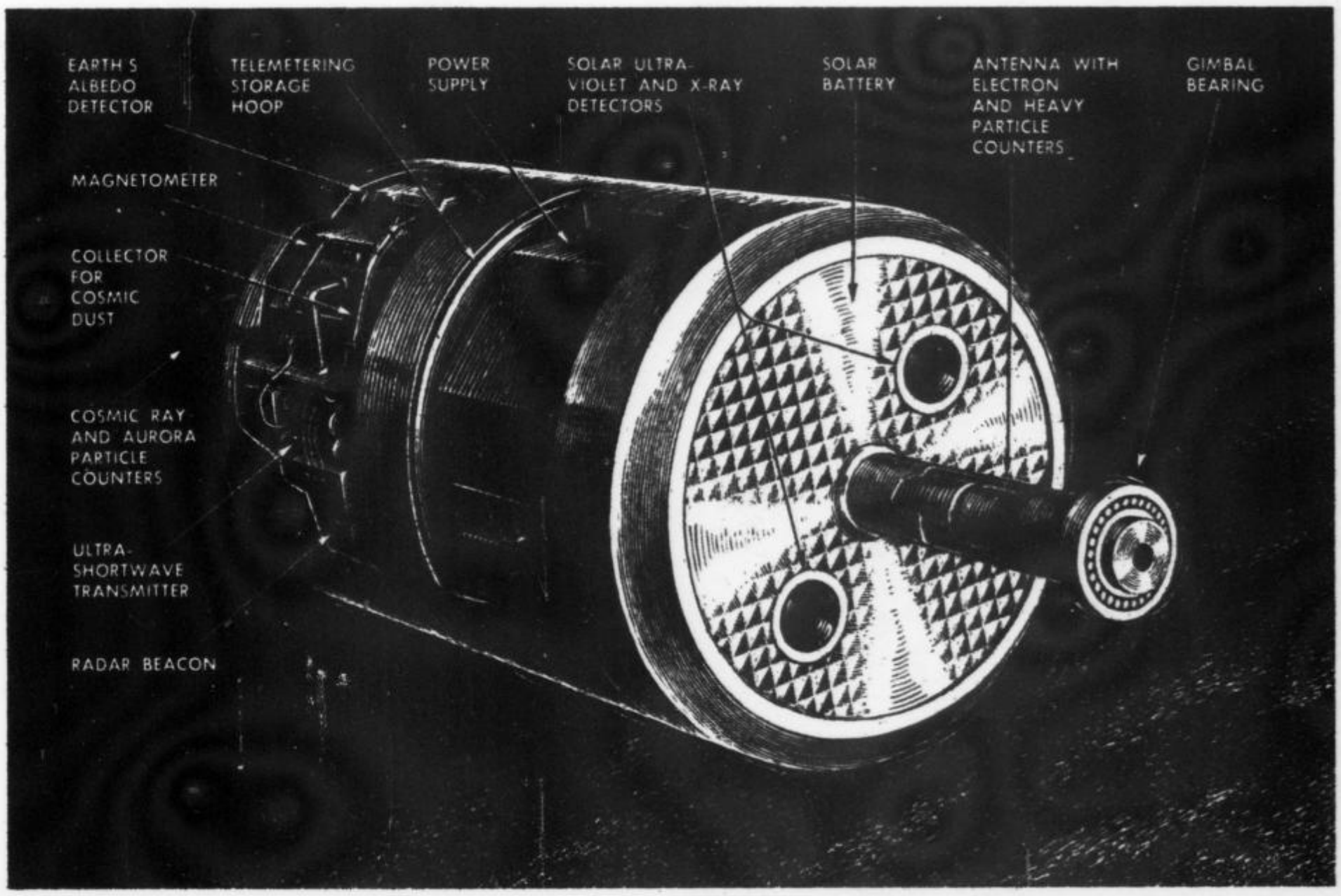
Dr. Harry Wexler of the U. S. Weather Bureau's Research Department is on record with the statement that space satellites will spot hurricanes on earth below, tracking them by radar and TV, giving warning far in advance. Moreover, from its high perch in space, the satellite will observe almost half a world at a time. It will see the whole weather picture—all cloud movements, winds, ocean currents and atmospheric disturbances. Out of this comprehensive pattern will come weather reports accurate for perhaps a month ahead!

Not only hurricanes but other major catastrophes on earth will be instantly spotted from the space satellite, with a long-range combined system of telescopes, radar and TV. Earthquakes, volcano eruptions, floods, tidal waves, even forest fires will be clearly seen. The day of disasters without warning will pass into limbo!

Serving as a space watchtower, the satellite could also locate ships lost at sea, or plane wrecks in lonely mountains, eliminating the need for a long blind search by planes on earth's surface.

Would you enjoy a TV program direct from Paris or Bombay? The space satellite will bring you that too, in time. Scientists point out that three TV satellites, set in a three-cornered orbit around the world, would be in direct visual line with one another, able to keep unbroken TV beams in operation. They can relay TV signals from any spot on earth down [*Continued on page* 172]

Artist's conception of first satellite, based on latest proposal by Dr. S. Fred Singer.

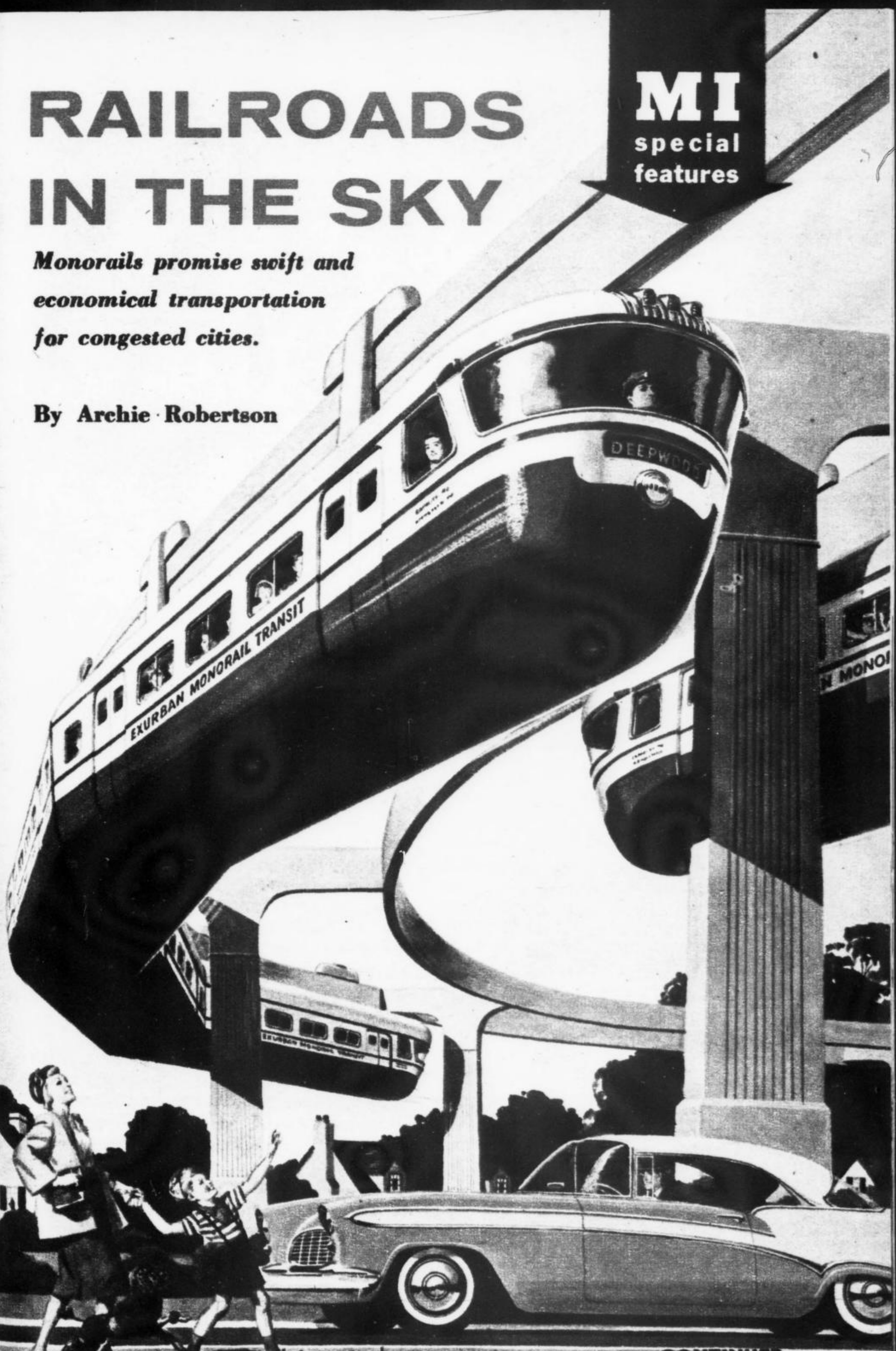


RAILROADS IN THE SKY

MI special features

Monorails promise swift and economical transportation for congested cities.

By Archie Robertson



CONTINUED . . .

The Fiberglas coaches of the Houston monorail are invitingly light and comfortable.

HERE'S a brand-new way of travel for American commuters—the overhead, suspended train. In a monorail coach, light and roomy as a luxurious airliner and faster than a surface train, you will skim along above the crowded downtown streets, looking with thankfulness at your escape from a misery of crawling cars, traffic fumes, honking horns, whistling cops and squealing brakes. Whether you're just going downtown to shop or commuting to work 50 miles from your home, a monorail will take you where you're going two or three times as fast as conventional surface transportation.

The Houston, Texas pilot monorail that opened for demonstration purposes last winter is only 970 feet long, and passengers are allowed to ride free. But in other respects, it is very much like the full-length lines which its backers plan to build soon.

The single "rail" of the Skyway, as the Houston line is called, is a 30-inch pipe supported by 30-foot towers set at 50-foot intervals. At one end of the present line the passengers ascend to a loading platform; at the other the rail declines to bring the coach to ground level. The passenger car hangs below the rail; above it ride the two 305-hp engines, the control equipment and driver's seat. The unit rides on eight pneumatic-tired wheels; 16 rubber guide wheels keep it in place on the rail. People who have taken the free trip report a nearly silent ride with little sense of motion. The coach has a Fiberglas body and large plexiglass windows; the effect inside is light, airy and cheerful. Seats along the sides accommodate 60 passengers and 50 more can stand comfortably.

The reasons for the monorail can be summed up briefly. Six million new cars coming along every year add to downtown traffic congestion which already causes an economic loss estimated in the billions. Conventional elevated

roads and railroads block light and air from the streets below. Subways and surface railroads lose money. And aircraft aren't yet ready for the job of carrying the public to work and back.

In several major population centers monorails are much closer to construction than the general public realizes. Their safety and dependability have already been proved in steel mills and other industrial plants, and full-scale plans for passenger-carrying monorails have been drawn for Los Angeles, San Francisco, Montreal, and Washington, D. C. The plan for Los Angeles awaits action by the California legislature, to enable the operating company to issue revenue bonds. It includes a 44-mile line between Fernando and downtown Los Angeles, with ten-car trains having a top speed of 100 mph. Even with 15 stops in this distance, the trains will maintain an average speed of 41 mph. This will make it by far the world's fastest transit system. (New York subway expresses average only 24 mph.)

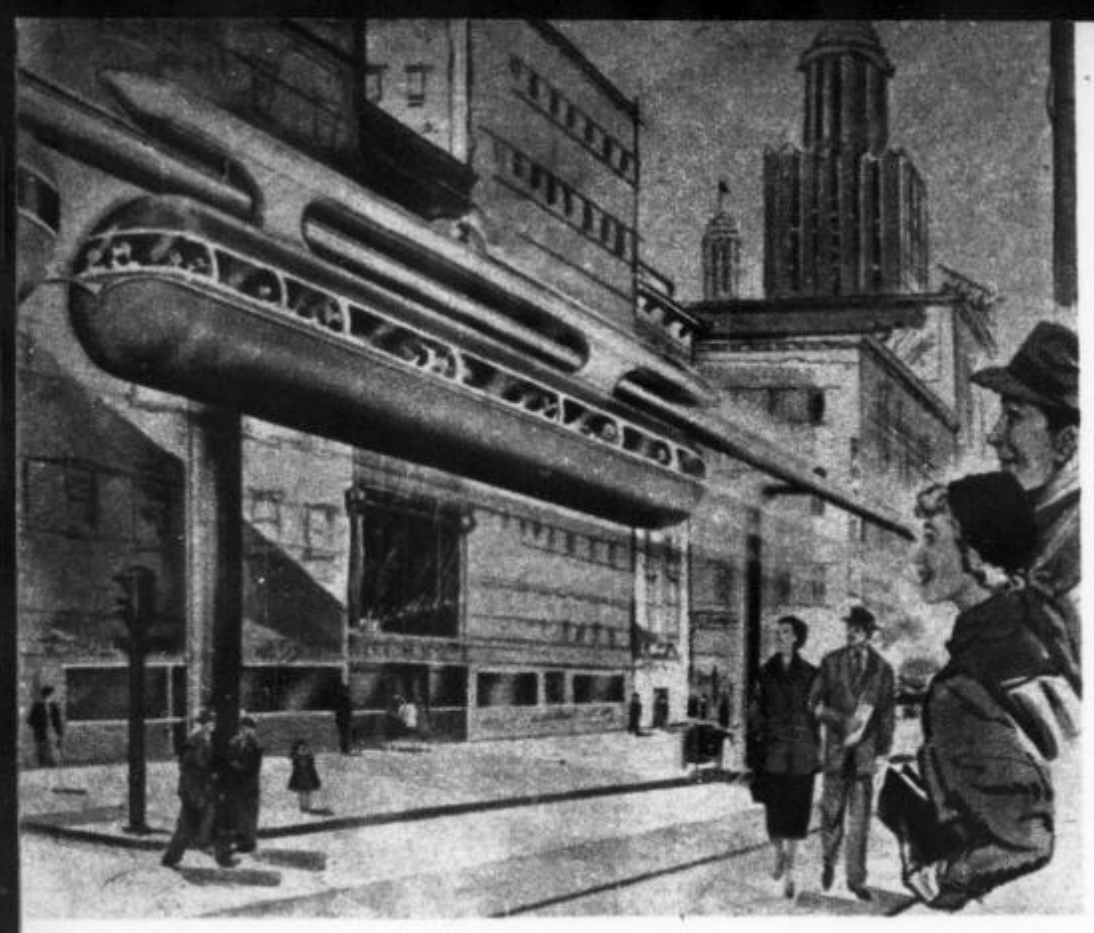
The Los Angeles monorail system, designed by Gibbs & Hill, a New York engineering firm, will have automatic train control. Trains will berth themselves correctly at each station. Doors will open and close by themselves. The train attendant will ride up front in a plexiglass bubble to watch for possible obstructions, like a tall crane passing below. In this case, of course, he'll be able to stop the train. Escalators will carry passengers up and down from the street.

One monorail plan eliminates bus-to-train transfers for off-line passengers. You'll be able to board a bus at your usual corner to start your trip downtown. When the bus reaches its monorail station a steel frame will be lowered from the overhead rail. The bus will drive into it, the frame will lock around it and hoist it up. Without leaving your seat in the bus, you'll be whisked over congested downtown areas to your destination.

The monorail is highly adaptable. In the Los Angeles plan, for example, it takes a dive underground to operate for two miles as a subway. Out in the country, its single row of pillars can be erected in the grassy, center strip which divides modern, separated expressways and thruways. Edward H. Anson, the vice president of Gibbs & Hill, has sketched a plan for a double loop monorail around the heart of Manhattan, with several cross-town lines to relieve congestion on the East-West streets. At rush hours, these are probably the scene of the nation's worst traffic snarls with a staggering loss in time and money as a consequence.

Monorail enthusiasts, of course, do not claim that theirs is the only answer to the traffic problem. More thruways and expressways are needed, all engineers agree. But expressways and thruways fill up with new traffic jams almost as fast as they are built. The New Jersey Turnpike is now carrying the volume of traffic which it was expected to carry some 30 years hence. Also, deluxe new highways always bring more cars into town every day, to be parked—somewhere. And they cost a lot to build, not only because of their massive construction but because expensive property must be condemned to secure the right-of-way for a city freeway. To build one mile of modern automobile freeway costs from $4,000,000 to $6,000,000; a monorail line of the same length costs

Monorail in Wuppertal, Germany, has run since 1902 without a passenger fatality.



Monorail advocates predict quiet, sunny streets when mass transport goes upstairs.

only $500,000 to construct.

When it comes to the number of people who can ride, the comparison is even more staggering. The monorail train—allowing for ten cars—can easily move about 24,000 passengers per hour, running on a 90-second headway between trains as in the Los Angeles design. Compare that with the mere 6,000-7,000 people who can travel a six-lane highway in private automobile during the same time—if we allow for the national average of about 1½ passengers per car.

It doesn't look as if we're going to build many more miles of subway systems or suburban surface lines. Virtually no subways have been constructed since 1940. They cost about four times as much to build as monorails and they lose money, steadily. The New York subway system, the world's greatest, runs deeper into the red every year as its passenger traffic declines while its fares go up. In general, the same sad story is true of commuters' trains around New York, Chicago, Philadelphia and other large cities. Almost without exception their managements report that the trains are run at a loss, schedules are being curtailed or service being abandoned altogether.

Highspeed buses, or trains of buses, running on elevated tracks above the city streets have also been suggested. But an elevated roadway, of any kind, has the serious disadvantage of cutting off the light and air from the street beneath it.

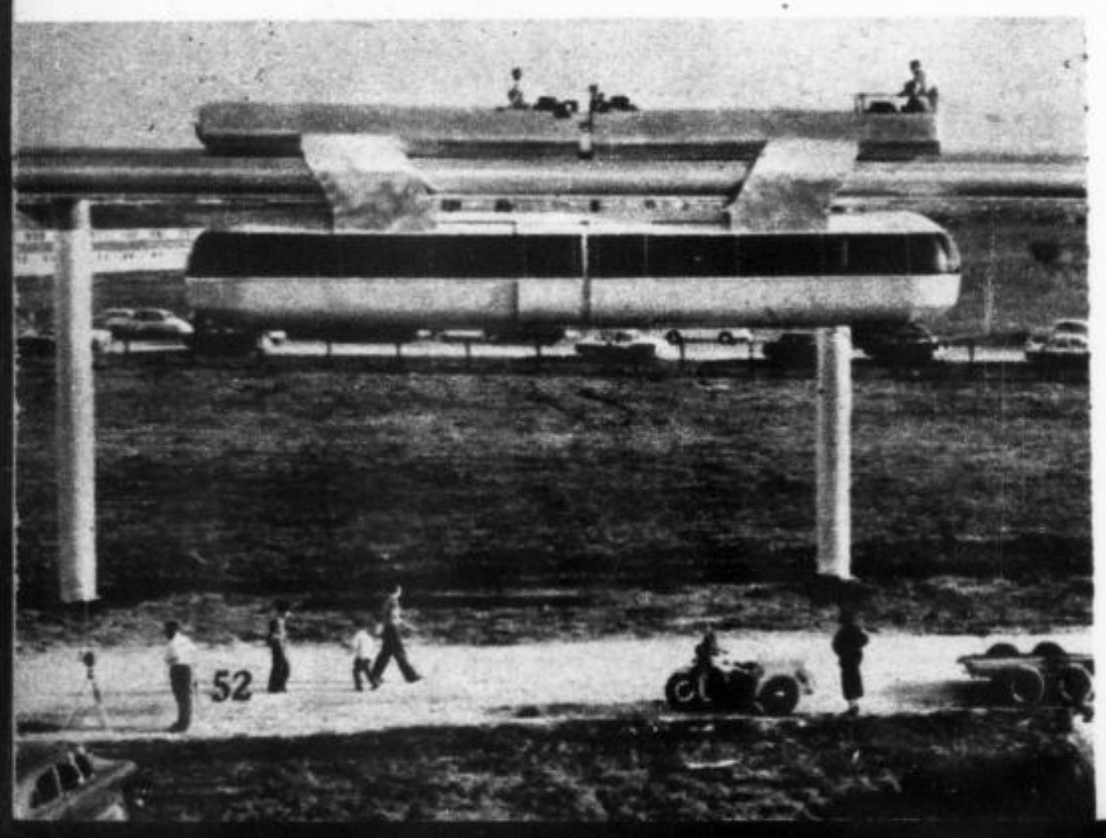
Monorails of the present are not remotely like the old elevated railroads. On the Houston line, for example, the pillars are spaced 75 feet apart in a single row. The light, airy structure deprives nobody of sunshine and fresh air. There's plenty of room for flowers and trees and no occasion for traffic accidents on the surfaces. Operations are quiet—no rumble, roar or clicking ties.

The monorail train isn't a new invention. It was proposed in England as early as 1830, and a few years later, a 20-mile line of single rail was built in the West of Ireland. A line was proposed to relieve New York traffic congestion in 1873.

Early monorails, however, were laid on the ground, or erected only a few feet above it, with engines and cars balanced upright on them. Such, for instance, was the famous, four-mile long Peg Leg Railroad in Pennsylvania, which opened in 1878 and unfortunately blew up a year later. The Bicycle Railroad—a similar design—skimmed along near Bellport, Long Island at 60 miles an hour, back in 1892. By 1901 an English monorail between Manchester and Liverpool was hitting 100 mph. In 1915 a monorail, elevated two feet above ground, ran between Bartow and City Island, N. Y. And of course for many years a little monorail car has been shuttling United States Senators underground between their office building and the adjoining Capitol.

Mechanix Illustrated

Short demonstration line in Houston, Texas, is selling the public on riding the monorail.



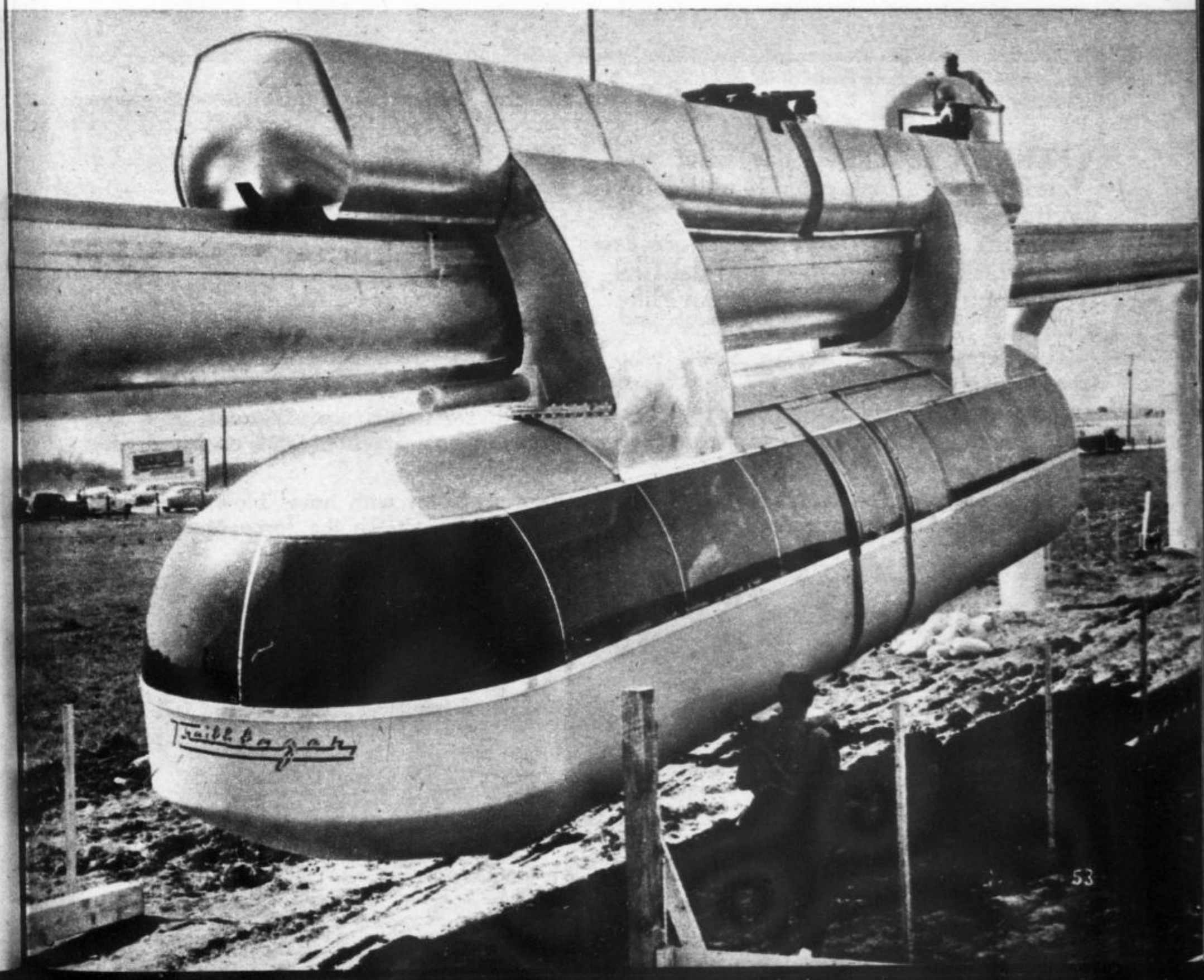
The most famous existing monorail, however, is at Wuppertal, in the Ruhr district of Germany. Nine and a half miles in length, it is a suspended, overhead type—like the new Houston line. It's been running, without a single fatality among a total of 310,000,000 passengers, since 1902.

"Overhead, upside-down railroad," though a clumsy phrase, may be a more accurate description of tomorrow's mass transportation than the word "monorail." While the Houston line has just one rail, the Gibbs & Hill design for Los Angeles is actually a narrow-gauge railroad, upside-down with the trains suspended from two rails, three feet apart. This split-rail design, engineers point out, makes switching a lot simpler than the single rail and offers other advantages. Rails, for example, can be enclosed inside a longitudinal box girder, treated with acoustic material, and they can rest upon a resilient, sound-deadening bed. Gyroscopes would not be necessary in the split-rail design. Even under stress equivalent to a 70-mph wind, the cars would lean less than 10 per cent from the vertical—less than some surface trains as they round a curve at high speed.

Maintenance costs on the monorail should be low. An enclosed track is safe from rain and snow. Brakes and motors on top of the cars are readily accessible for inspection and repairs.

What will it cost to ride it? According to the Los Angeles plan, the rate may be about 2.8 cents per mile which compares with an average nationwide cost of 8 cents a mile for operating a privately-owned automobile. And no more than you pay now to ride a bus or train which is tied to earth. •

Closeup of Houston monorail coach nearing station. Note over-the-rail driver's cab.



EMERGENCY FLOATS being tried here by Sikorsky S-55 helicopter can be inflated by pilot for any unscheduled landings on water.

TV COMBAT CAMERA developed by Army enables scout to send up-to-the-minute battle pictures to command post.

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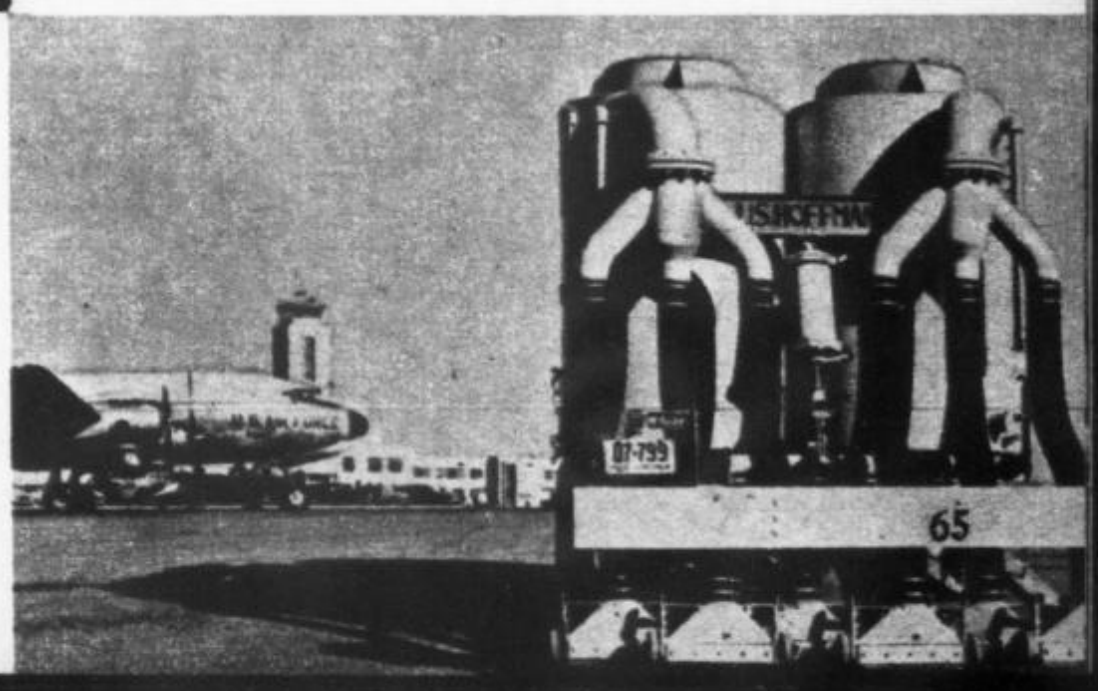
IT'S NEW!

VACUUM CLEANER built by U. S. Hoffman Machinery Corp. weighs 15 tons, cleans runways of rubble to protect jet intakes.



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NEW

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VOLUME 50 NUMBER 3

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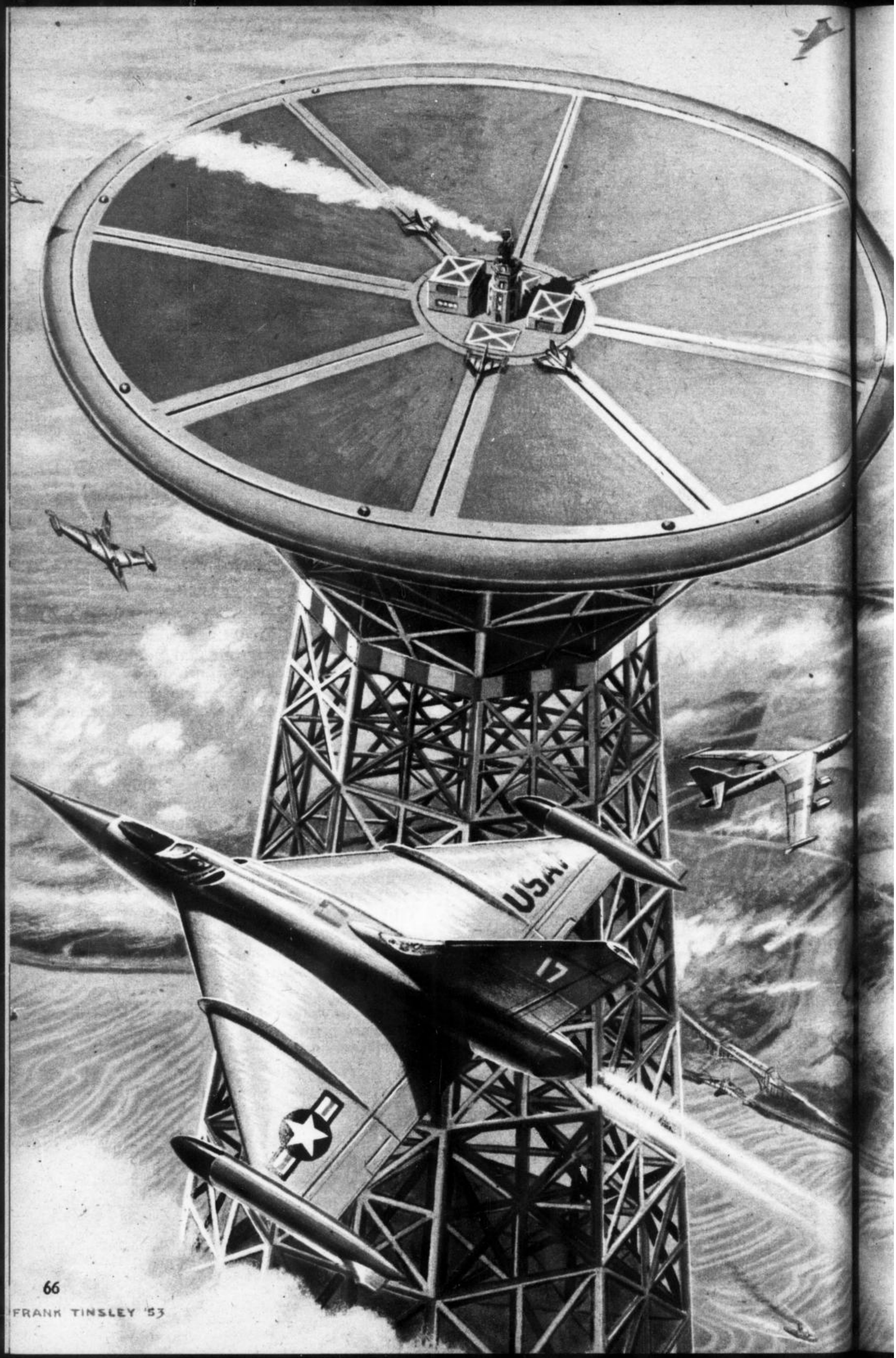


66

FRANK TINSLEY '53

Why Don't We Have . . . STRATOSPHERE AIRPORTS?

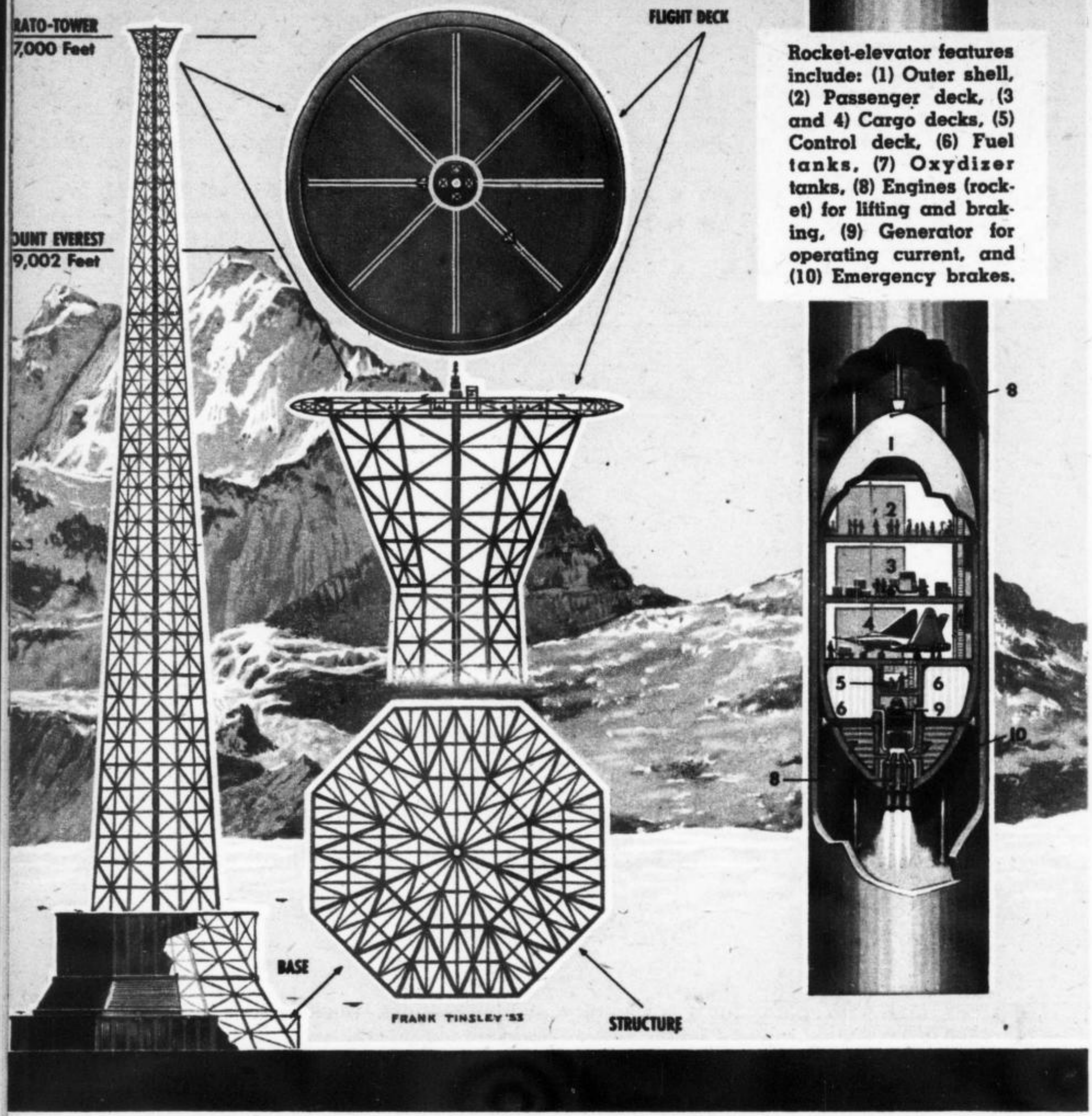
Interceptor planes, operating from above-the-weather seven-mile-high air bases, could fight off any invader.

By Frank Tinsley

PRELIMINARY plans for a series of $500,000,000 steel towers, seven miles high and a mile square at the base, were unveiled to leaders in the engineering and science fields at a recent meeting in New York's Hotel Astor. The project, one of literally top flight status, was proposed by consulting engineer Morris Berman, President of the New York Society of Engineers and inventor of the stressometer, a device that accurately measures the stresses and strains of bridges, buildings and other structures in course of design.

Berman's projected sky tower would not only be the tallest man-made edifice ever built but would top grim Mount Everest by some eight thousand feet and would be the loftiest eminence on earth! Reaching into the lower stratosphere, the structure would be capped by an airplane flight deck from which jet fighters could take off and land high above the storms and weather of the troposphere. As most defensive interceptions now take place at 50,000 to 60,000 ft. altitude, the present time lapse for climbing to combat levels would be reduced by more than 50 per cent.

There is, of course, nothing new in this notion of a guardian tower. From time immemorial, hilltop watchtowers, mountain-high signal stations and far-flung outposts have been the keystone of man's military defenses. This idea of outlying warning systems has persisted in one form or another right down to World War II when flak towers of armored concrete were one of the prime hazards encountered in our aerial bombardment of Nazi Germany. Today the fantastic increase in the speed and de-



Tremendous height of the airport tower can be seen above left in its comparison to Mount Everest, now the highest spot on the earth. Center are expanded views of flight deck, upper section and base, showing structural pattern.

structive power of the modern sky raider has elevated the vital importance of these defensive sallyports to an even greater degree. Expensive as it may seem at first glance, Mr. Berman's sky tower could easily earn its cost in a single, big, metropolitan raid. In addition to preventing the destruction of billions of dollars worth of property, it might be the means of saving millions of precious, American lives!

The sky-tower project is now in its preliminary layout stage and details of its structural design and equipment are still hazy. The basic idea has such intriguing possibilities, however, that your editors have visualized an MI tower design based upon accepted engineering practice. It differs from Berman's four-square concept in that it is octagonal in section with legs splayed out, Eiffel Tower style, for greater strength and stability. To minimize the stress of wind and weather, an open basketwork structure is employed with tubular members and faired joints to increase the efficiency of its streamlining.

It is difficult to visualize the size and span of these components. With a skyscraper-like base covering over two square miles, our tower would be the most colossal edifice ever constructed. Just

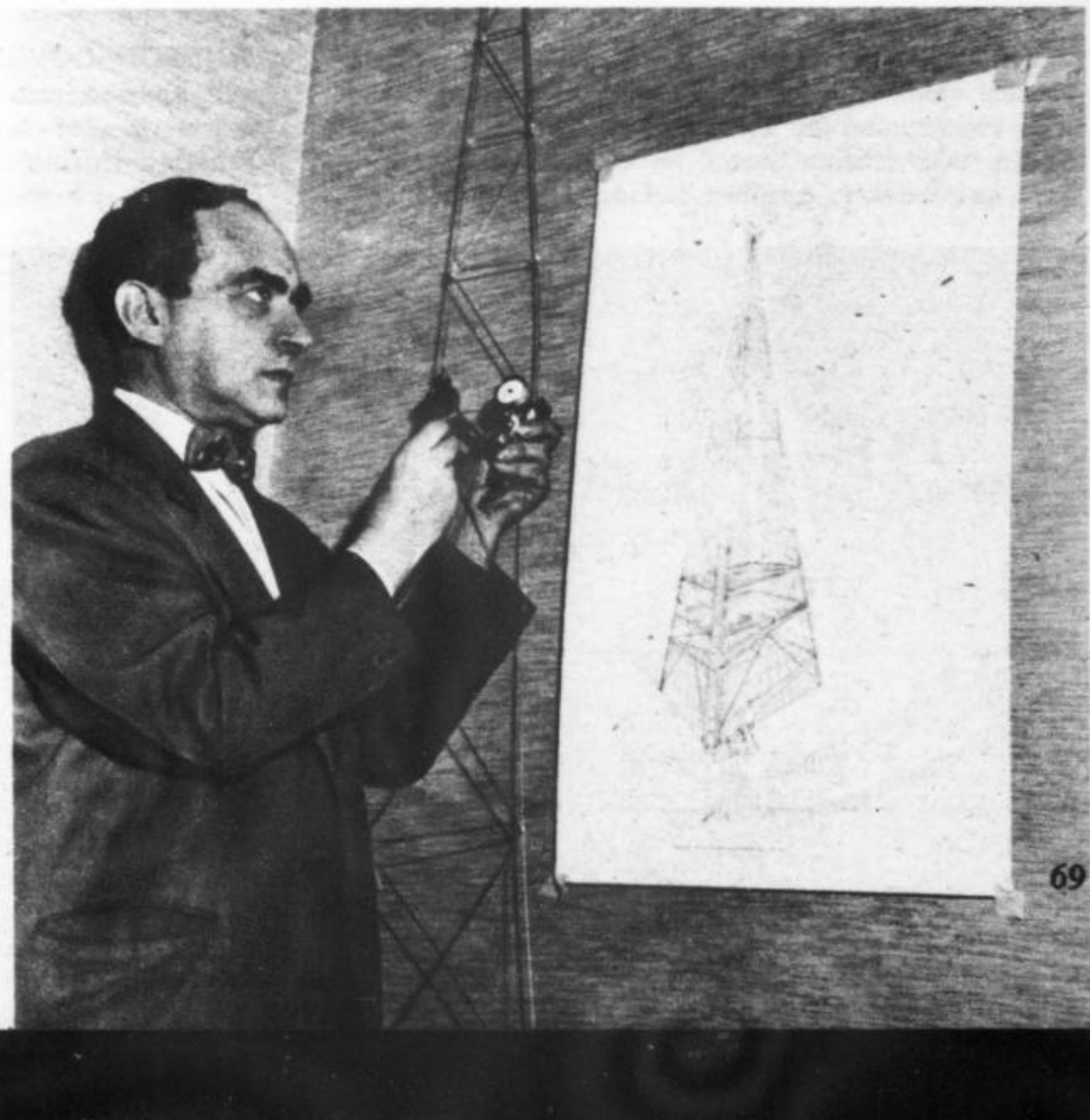
above the base, some of the principal members would span more than 2,000 ft.—the length of a good sized bridge.

To obtain the necessary rigidity, each would be as big around as many of our subway tunnels and under-river traffic tubes. Assembled in welded sections and lighted by airtight portholes, they would contain access stairways, self-service elevators, etc. for proper inspection and maintenance. Upper sections of the eight uprights would double as tanks, holding fuel for the jet fighters, water for the crew, etc.

The flight deck atop the tower is unique among launching designs. Equipped with eight diverging catapults, it is doughnut shaped in plan form. In action, it rotates like a merry-go-round about a fixed center island and within a fixed rim. The fighter planes, standing ready to fly at a moment's notice, are turned successively into the wind and shot off like bullets from a revolver. Meanwhile, four plane elevators, set in the central island, lift reserve jets to the deck where they are hustled on to the catapults. Highly organized aircraft-carrier techniques are employed and a continuous stream of fighters are spit into space to intercept enemy raiders. Returning jets land with equal celerity. The slowly revolving deck pauses momentarily as each sets down and is arrested. Then it swings again to take another on the next vacant sector. Deck crews in space suits hustle the planes down to elevators which are fitted with winch and cable gear to facilitate handling. As planes land into the wind on the opposite side of the deck from those taking off, both operations can be handled simultaneously. A tall control tower, set in the dead center of the island and high enough to clear the raised elevators, directs all flight operations. It is equipped with floodlights, radio, radar and all necessary landing aids. A pilot's ready-room occupies its deck level.

Immediately beneath the flight platform is a sort of "tween decks" space taken up by the catapult mechanisms, heat, auxiliary power, air-conditioning plants, etc. Below that is a lofty, carrier-type hangar deck where the fighters are parked between flights. It is fully pressurized and air conditioned. The central service area of this deck rotates like the flight deck above, to facilitate plane movement on and off the elevators. Shops, tool and spare parts stowage, crew rest-rooms, etc., are set around the perimeter. The next and final level is entirely given over to offices and quarters for the station personnel. Sleeping rooms, lounges, library, television and a movie theatre help pass the time for the off-duty watch.

Communication with the ground—some seven miles below—is by rocket elevator. At such heights, conventional cable-hung cars are obviously impossible. Using the Empire State Building as a yardstick of extreme permissible cable lengths, some 35 stages and car changes would be required to reach the top. This would consume much too much time—several hours each way—and complicate the handling of freight and supplies. It would also be tremendously expensive to install and operate. The only practictal answer lies in a single central elevator shaft, circular in section and large enough to accomodate planes, trucks and heavy freight. [*Continued on page* 202]



Morris Berman, President of the New York Society of Engineers and inventor of the stressometer, works here on part of a model for one of the proposed seven-mile-high stratosphere airport towers.

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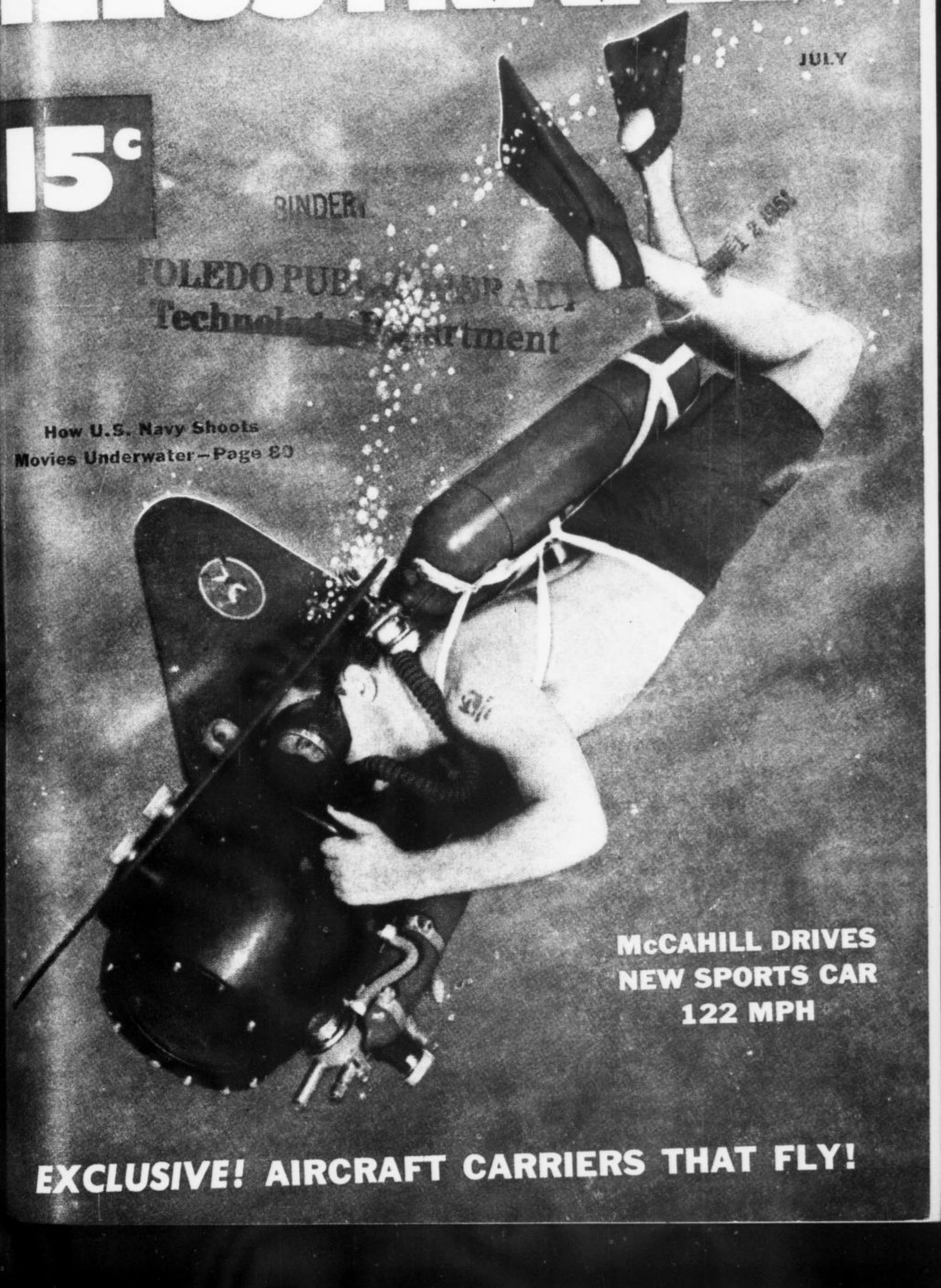

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EXCLUSIVE! AIRCRAFT CARRIERS THAT FLY!

JULY 1951 • VOLUME 45 • NUMBER 3

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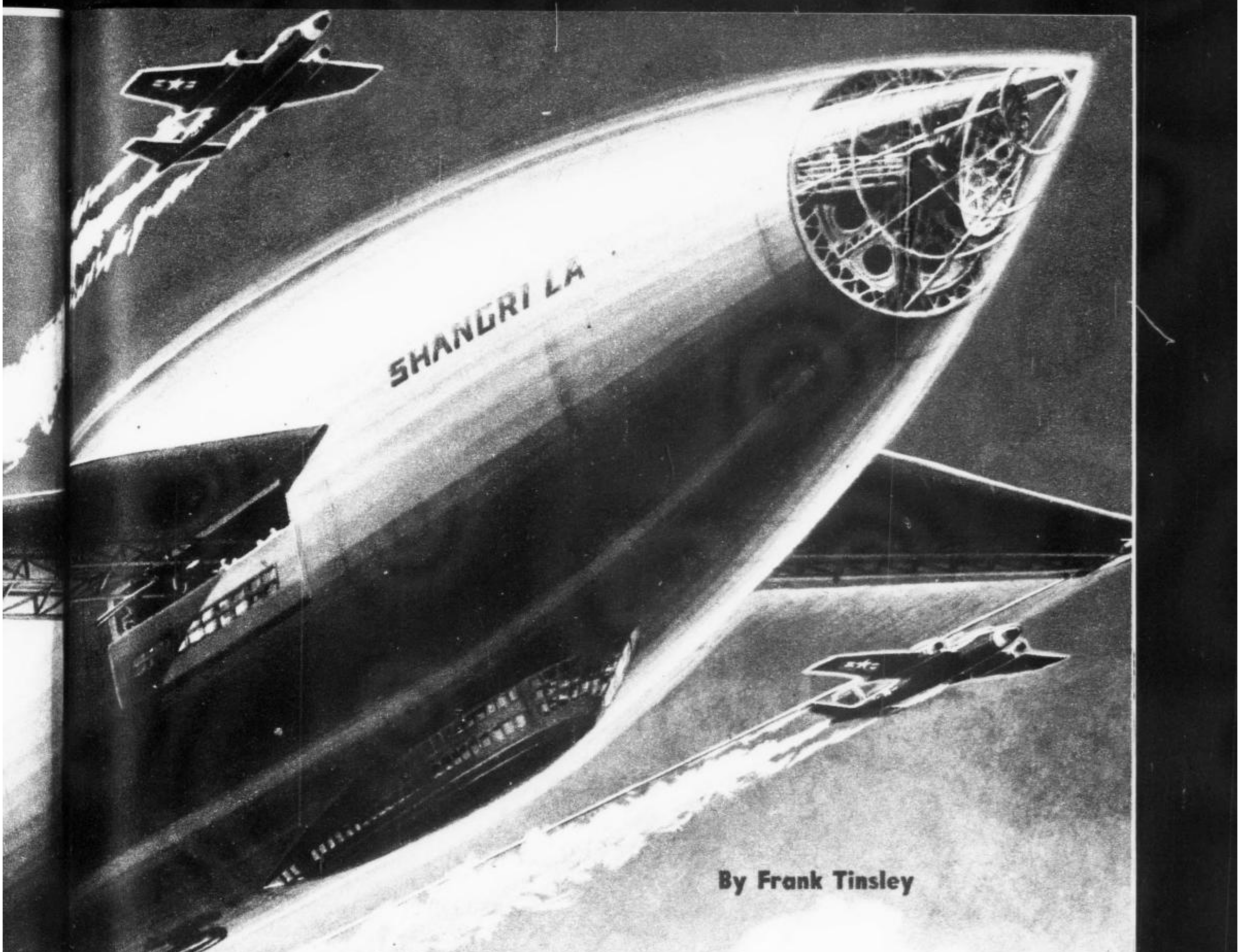
Why Don't We Build...

FLYING AIRCRAFT CARRIERS



By Frank Tinsley

A jet-propelled super-dirigible carrying a fleet of atom bombers would be the deadliest weapon of aerial warfare.

A giant rigid-type dirigible is the only kind of aircraft capable of carrying a flight of atom bombers into the heart of enemy territory. And it is possible to build this equivalent of the modern sea-going aircraft carrier. How? The answer is concealed in files of the U. S. Navy forgotten since the loss of the giant dirigible Macon in 1935.

Let's see how such a ship might be constructed using the know-how we already possess.

It would be huge, much larger than the Macon and Akron. It would be about 1,350 feet long and 150 feet in diameter with a displacement of nearly 12,000,000 cubic feet. With eight jets developing 80,000 pounds of thrust, its top speed would exceed 300 mph.

Rather than a construction of wire-braced circular frames connected by longerons and covered with fabric as had its predecessors, it would have a fish-like skeleton. From a central spine would radiate spoke girders forming structural wheels the rims of which would be connected by longitudinal girders. A metal skin such as that used on the ZMC-2 in 1930 would furnish additional strength.

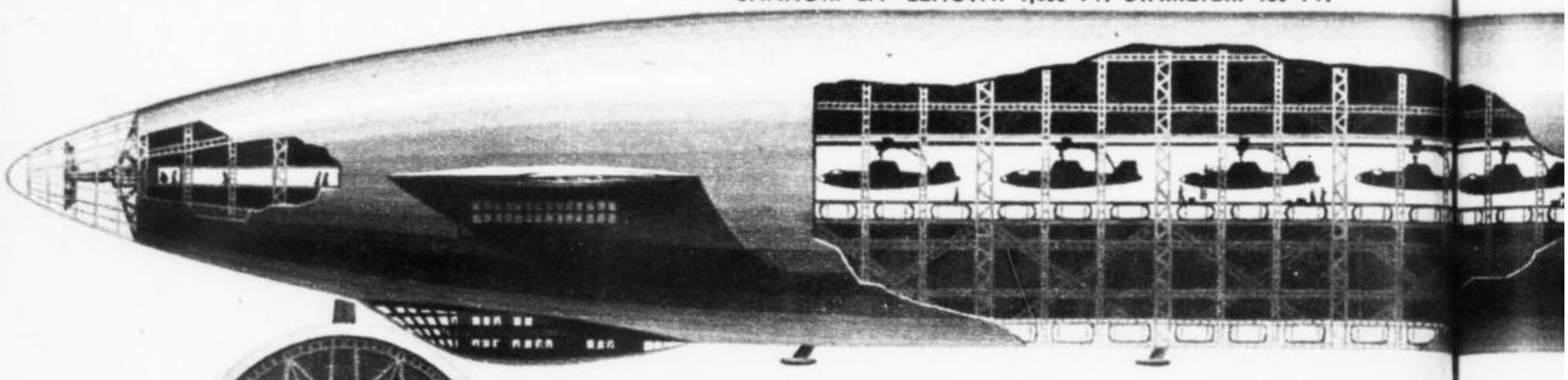
In this ship such a metal skin would be a necessity because of the stresses involved in high-speed flight. Its gas-tight character would eliminate the internal balloonets previously necessary for holding helium. Gas-tight main frames would divide the ship into separate compartments, making it practically unsinkable.

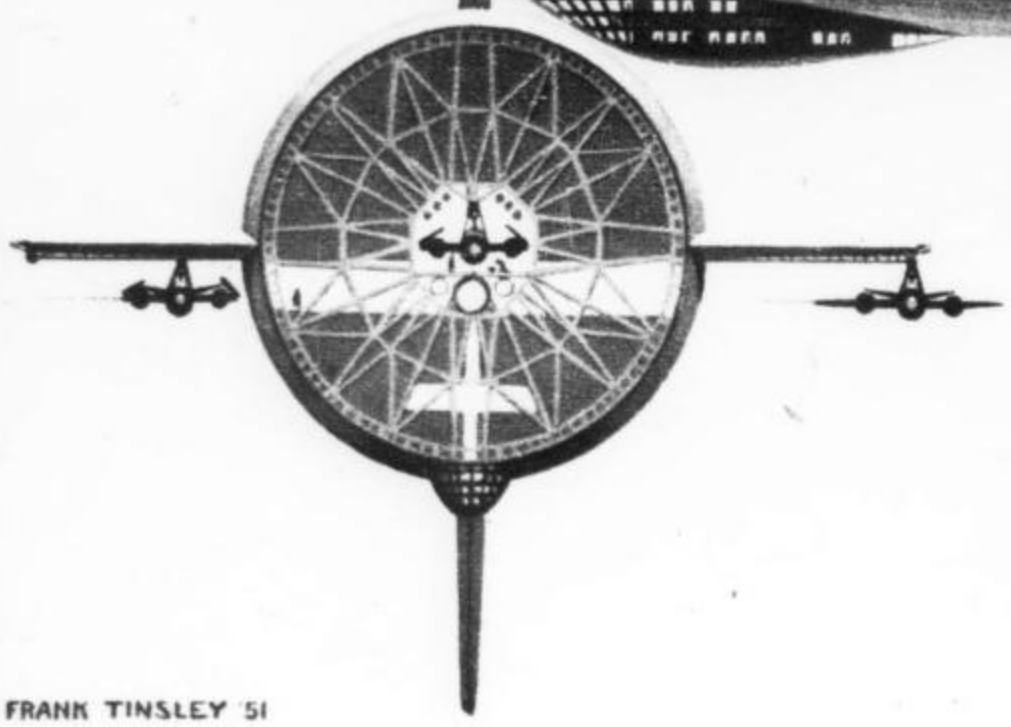
Within the ship's hollow spine would be

At right is a top silhouette of the proposed ship compared with that of the old Macon, far right. Lines differ; ratio of Macon's diameter to length was six. Ratio of Shangri La would be closer to nine.

SHANGRI LA—LENGTH: 1,350 FT. DIAMETER: 150 FT.

MAC





FRANK TINSLEY '51

At left is a main frame, showing the extreme strength of the new design. Seventeen of these would divide the ship into as many gas-tight compartments. This drawing and cross-section above show how atom bombers or fighters are stored on an overhead cable in the ship's hollow backbone, and how they can be moved through large ports to the ends of the launching rails. In above view, front port to be used for planes' return is shown closed by bomb-bay type doors.

the hangar with overhead monorail suspension for planes. The launching system would be a pair of Brodie Wires stretched between the tips of the ship's forward wings and horizontal tail surfaces. The ends of these wires would be secured to movable tracks so that the units could be retracted into the fuselage when the planes have returned and have been withdrawn into the hull. In such a position the wires would lie along the sides.

The dirigible's defensive armament would be developed by tactical test. Its tremendous load-carrying ability would permit heavy guns or air-to-air missiles in greater quantity than that carried by any attacking plane presently designed.

Let's stow away aboard a dirigible of the proposed type and accompany her on a typical mission.

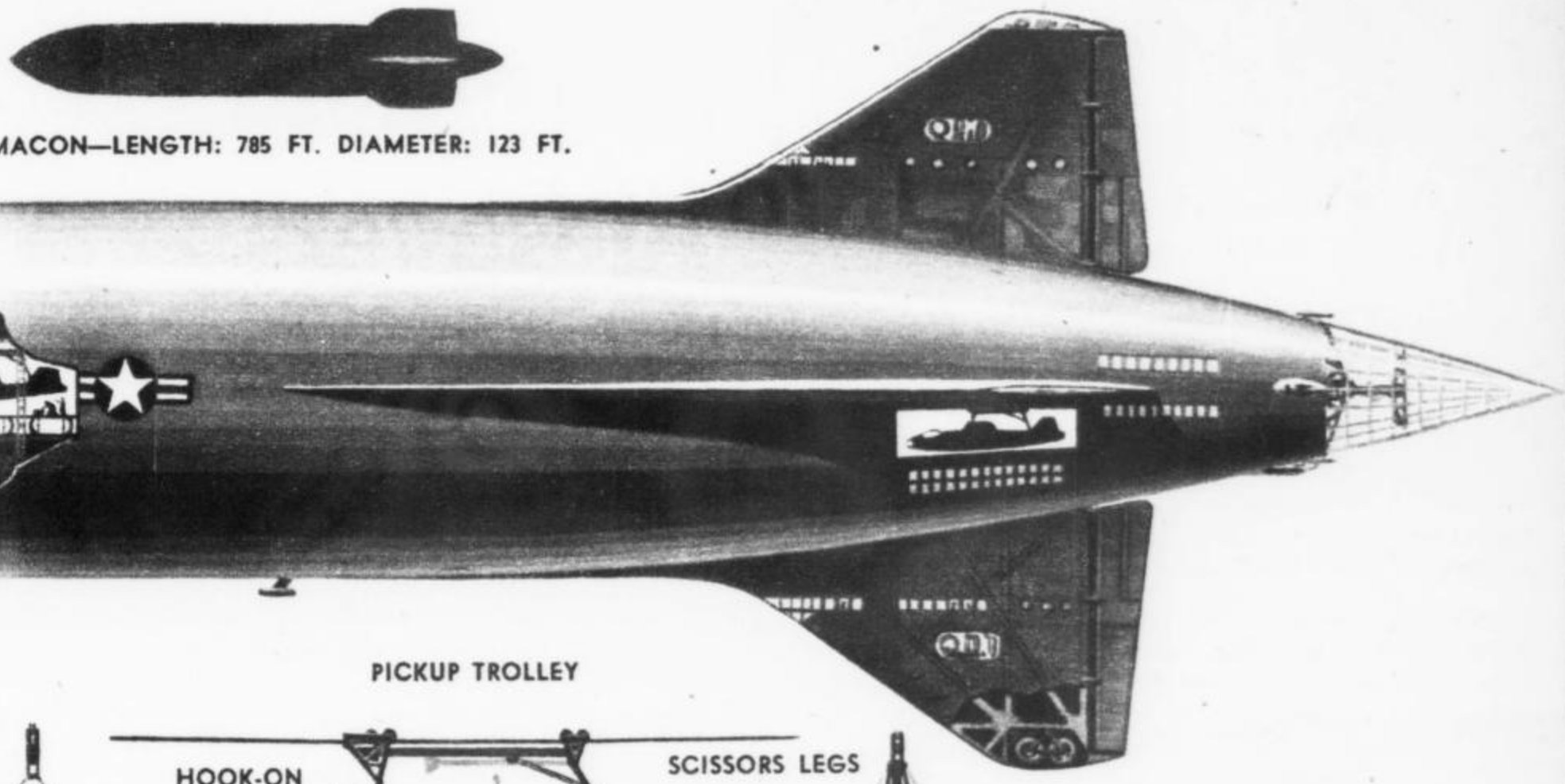
Shangri La takes off from a remote northern base, safe from spying eyes, and heads toward her objective. Through the darkness of the thin, upper atmosphere the great silver cylinder speeds. In nose and tail, all-seeing electronic eyes sweep the heavens as the big 30-foot radar scanners tilt and turn in overlapping 260° circles. At the perimeter of her radar zone fly the scouts, extending the range of her scanners with their own small sets. Thus she covers an enormous sphere of space and can pinpoint an approaching aircraft or missile at ten or a dozen times its own radar range.

Half way in from the scouts is a circle of escort fighters, ready to repel an attack long before it gets within sight of the dirigible. Thus protected like a surface carrier surrounded by swift destroyers, Shangri La noses toward the enemy targets. Suddenly the Combat Director clicks the switch on his intercom. "Bomber number one—prepare to launch!"

Back in the tail of the giant dirigible the designated bomber is pushed along overhead rails and switched into the transverse launching gangway. The plane crew scramble from the adjoining ready room, climb into their cockpit and lock the airtight, transparent enclosure. The Launch Master nods, flicks one of his array of switches and the big, bomb-bay type doors at the end of the gangway slide downward.

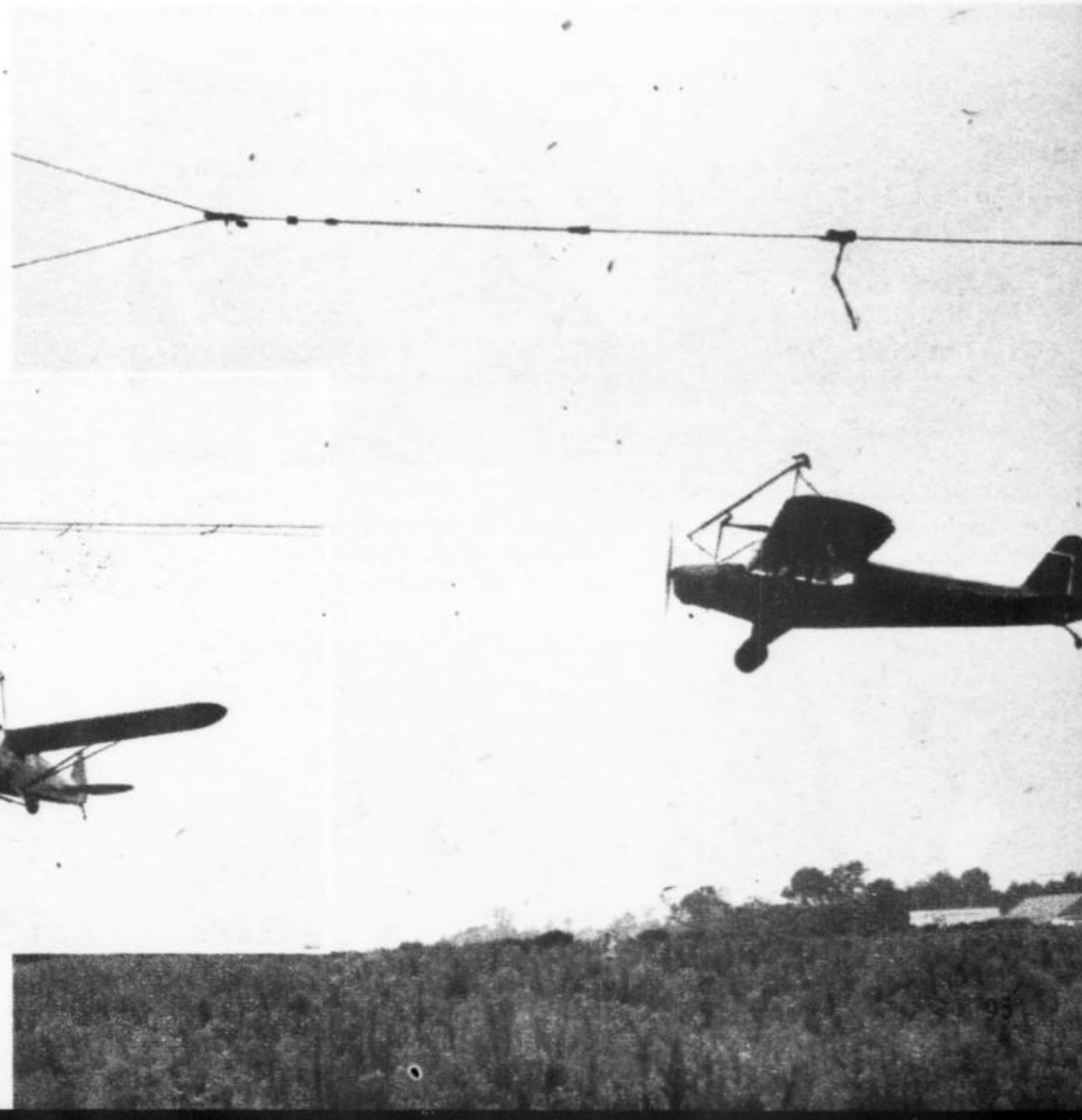
Jato rockets blast, the trolley carrying the bomber spurts up the Brodie Wire and the plane is off.

A dream? Now, perhaps, but well within the realm of possibility. •



Above, long-range radar scanners in nose and tail cover 260-degree field. At left are details of the Brodie Wire. Retractable hook on plane engages loop from trolley which runs on wire. Trolley can be switched to transverse rails.

Brodie Aerial Track Airport has operated with a Piper Cub. At right the trolley releases plane for take-off. Below, it approaches for an aerial-track landing.



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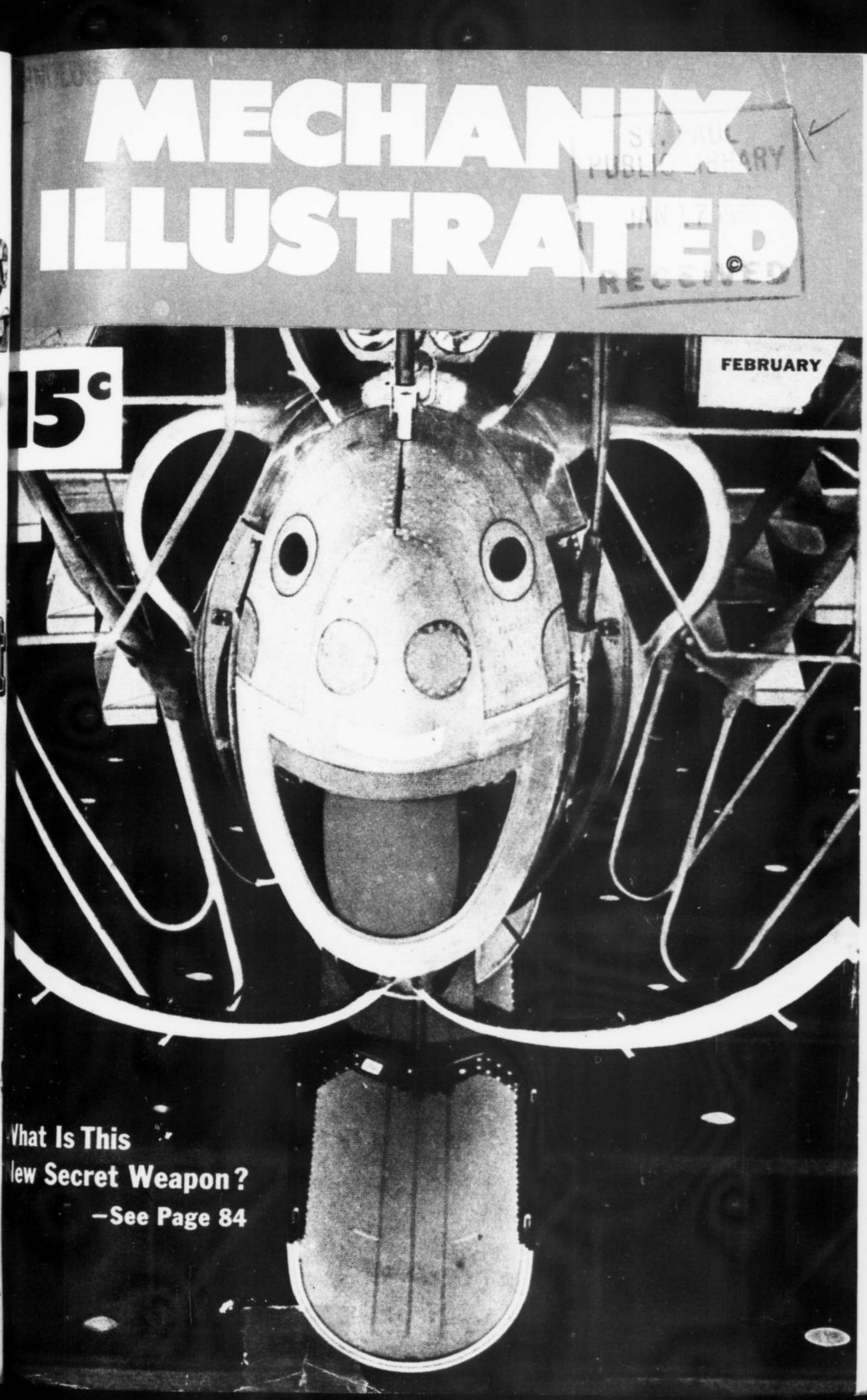

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XUM

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Why Don't We Build...

CONVERTAPLANES

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With the airliner's speed and the helicopter's maneuverability, they would make air transportation safer and more practical.

By Frank Tinsley

TODAY'S transport airplane is a highly efficient, rugged, comfortable and fast vehicle. It is safe, too, once it has reached its altitude. As a matter of fact it is about as safe as any other form of mass transportation. There are certain dangers inherent in flying, however. Chief among them is the fact that the plane must take off and land at high speeds on long runways. These moments of taking wing and returning to earth are critical and they become even more so in ground fogs, cross winds and snow. They are the moments in which 90

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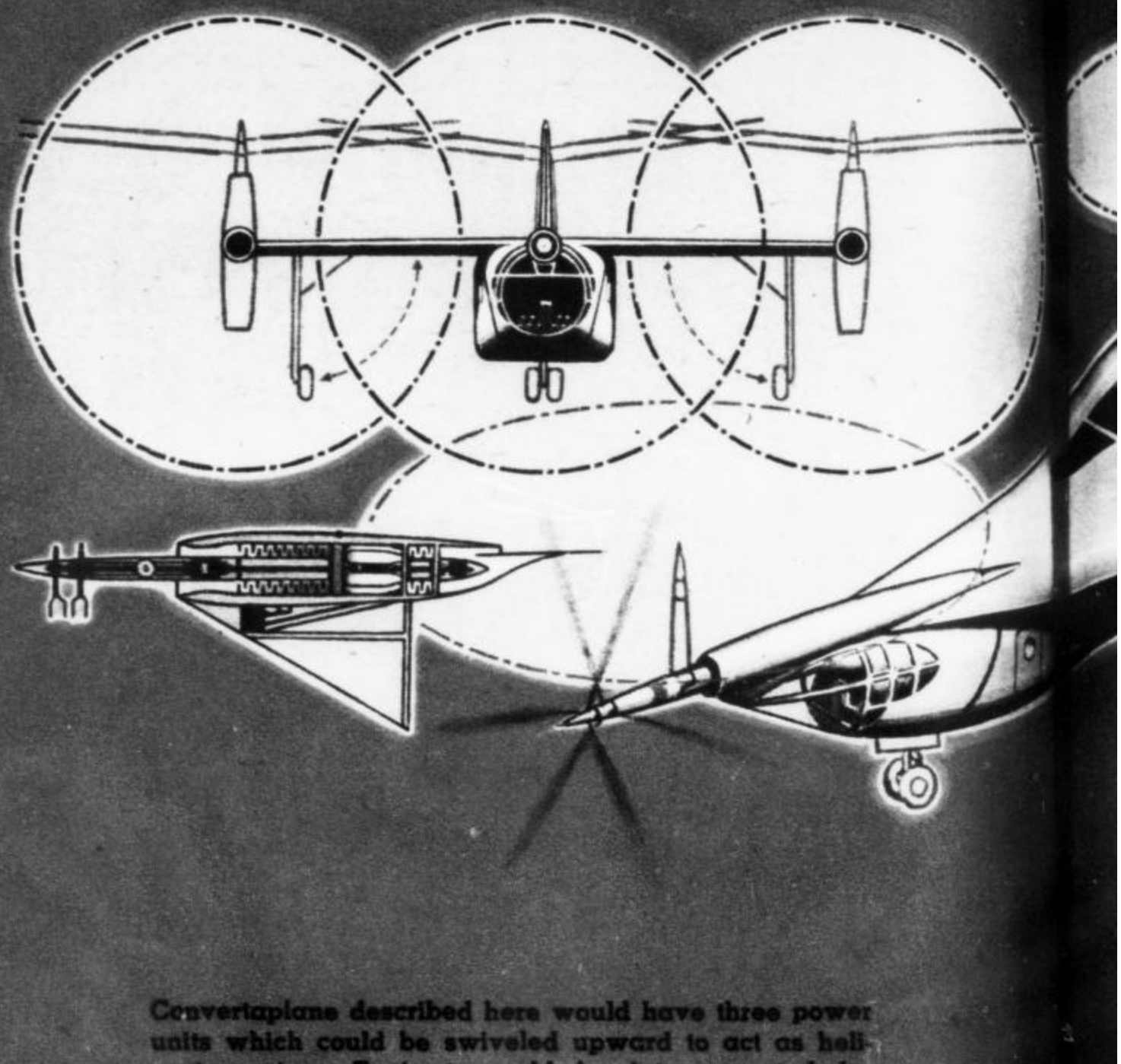


Earliest was Herrick's, above, in which biplane's upper wing was unlocked and made to rotate as in a helicopter.

Convertaplane described here would have three power units which could be swiveled upward to act as helicopter rotors. Engines would be interconnected by shafts so if one should fail, others could take over.

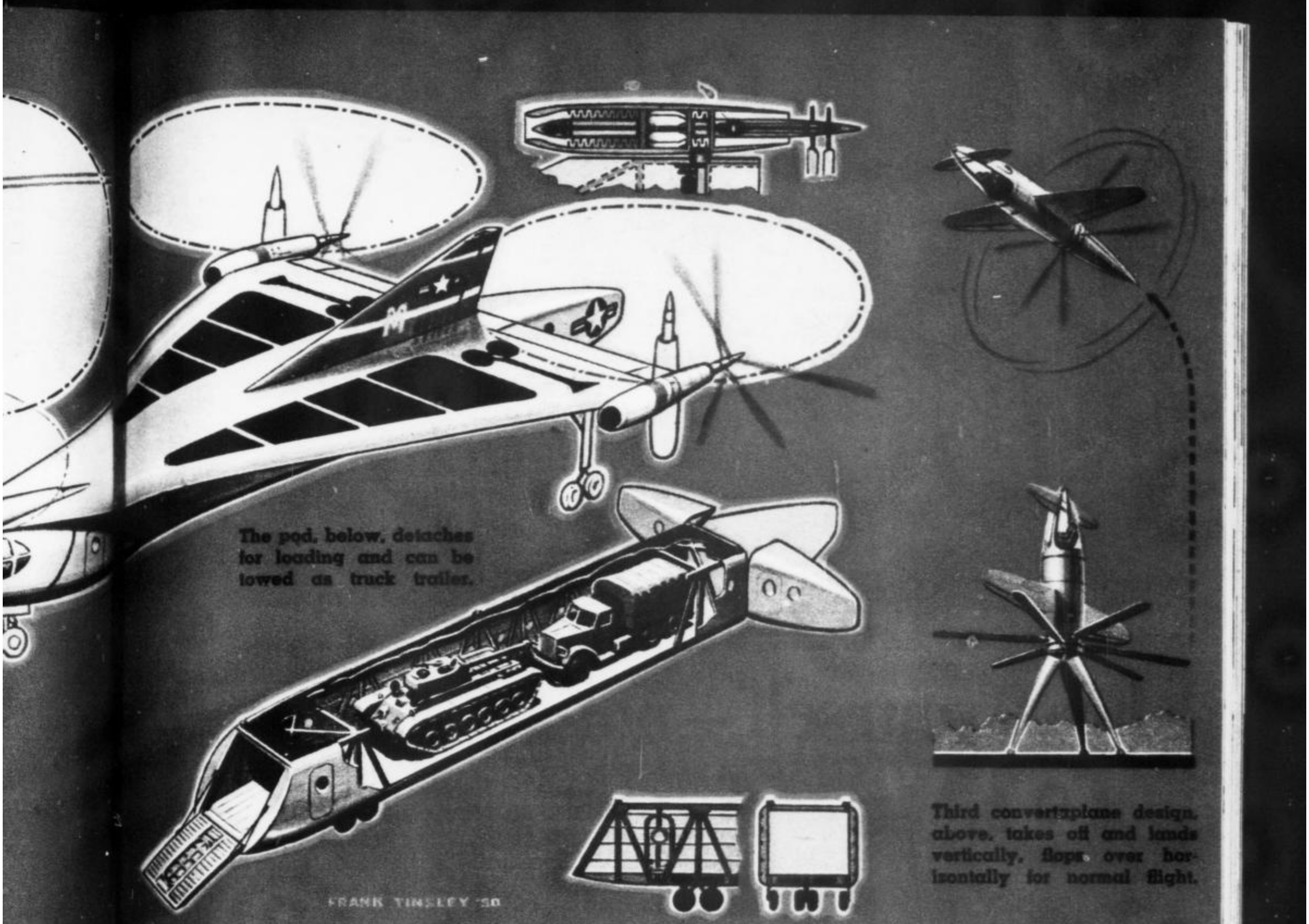
per cent of all air accidents occur. Then, too, long runways are expensive. They take one of the biggest single bites out of your air-travel dollar. And the land area required for this criss-cross complex of concrete pushes the airport so far out of community centers that time gained in flight is lost in field-to-town travel. In short, today's airplane may be fast and comfortable but it is expensive in ground time and space, and not nearly as safe as we would like to have it.

The helicopter, on the other hand, solves all of these problems. It is the only aircraft that carries its own, build-in parachute and it lands at practically zero ground speed on the proverbial dime. It can buzz right in over a field at cruising speed and altitude, hover as long as necessary, then descend vertically. It touches down on terra firm under full flight control as slowly and lightly as a feather and in little more space than the diameter of its own rotor. There are only two faults with the present day helicopter. Its range is short and compared to the airplane, it is slow as molasses.

Why, then, can't we have a fast-flying, slow-landing transport that can convert in flight from helicopter to airplane and back again? The answer is that such a plane is on its way. Despite the inertia that retards all new concepts and notwithstanding the knotty technical problem involved, the logic of the convertaplane can't be denied.

Back in the thirties Gerald P. Herrick of New York, often called the father of the convertaplane, built and flew successfully full-scale prototypes. They were biplanes whose pylon-mounted upper wings could be unlocked and spun as auto-gyro rotors. His latest model, a low-wing pusher plane, is fitted with an upper rotor-wing driven by small jet engines mounted in its tips.

A later method of conversion is a bit more startling. A missile-like aircraft, equipped with sub wings, rotor propellers and folding, tripod-like landing gear in its tail, takes off from a vertical position. Upon reaching altitude, it rolls over into a hori-



Third convertaplane design, above, takes off and lands vertically, flops over horizontally for normal flight.

zontal attitude and becomes a wing supported airplane.

A third variation probably will prove to be the most practical method of conversion. In this type, the convertaplane resembles a conventional air transport fitted with huge, slow turning propellers. Conversion is accomplished by rotating the engines and their props in a quarter-circle from the vertical to the horizontal axis of thrust.

In the design shown here the most advanced ideas have been used. Triple gas-turbine power units are arranged in a triangle for balanced suspension. Passengers, cargo, etc., are carried in a separate body or "pod" locked beneath the wing. Fitted with quick release attachments, the pod can be detached speedily from the parent plane to facilitate handling. On the ground, it operates as a trailer bus or truck and contains its own retractable wheel gear.

The pilot's compartment is placed in the convertaplane's nose with full vision forward, up and down. The wing is fitted with "elevon" combination control surfaces. Its triangular plan structure is tremendously strong and rigid, providing ample support for the outboard power units and wide-tread landing gear.

In horizontal flight, the forward power unit functions as a tractor propeller and the rear pair as pushers. The latter are fitted with standard controllable-pitch devices and as they rotate, blade angles are automatically changed from full push to zero and then to full pull whereupon they become tractor rotors lifting upward. While this is taking place, the forward rotor which requires no blade change maintains the convertaplane's speed.

Last September, the Air Force and Army opened a design competition for convertaplanes. Specifications for military models have been distributed. At last, the pioneers of this new form of flying machine can go ahead with the promise of government support. And Uncle Sam will be the first to blossom forth with an air-transport service that is convenient, speedy and safe! •

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A Fawcett Magazine

1945

JANUARY

STILL 15c

DEEP-SEA SCHOOL
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IN FULL COLOR YOUR PRIVATE PLANE

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JANUARY, 1946 **VOL. XXXV NO. 1**

On the cover: *Color photo of Navy diving bell by J. J. Fanta*

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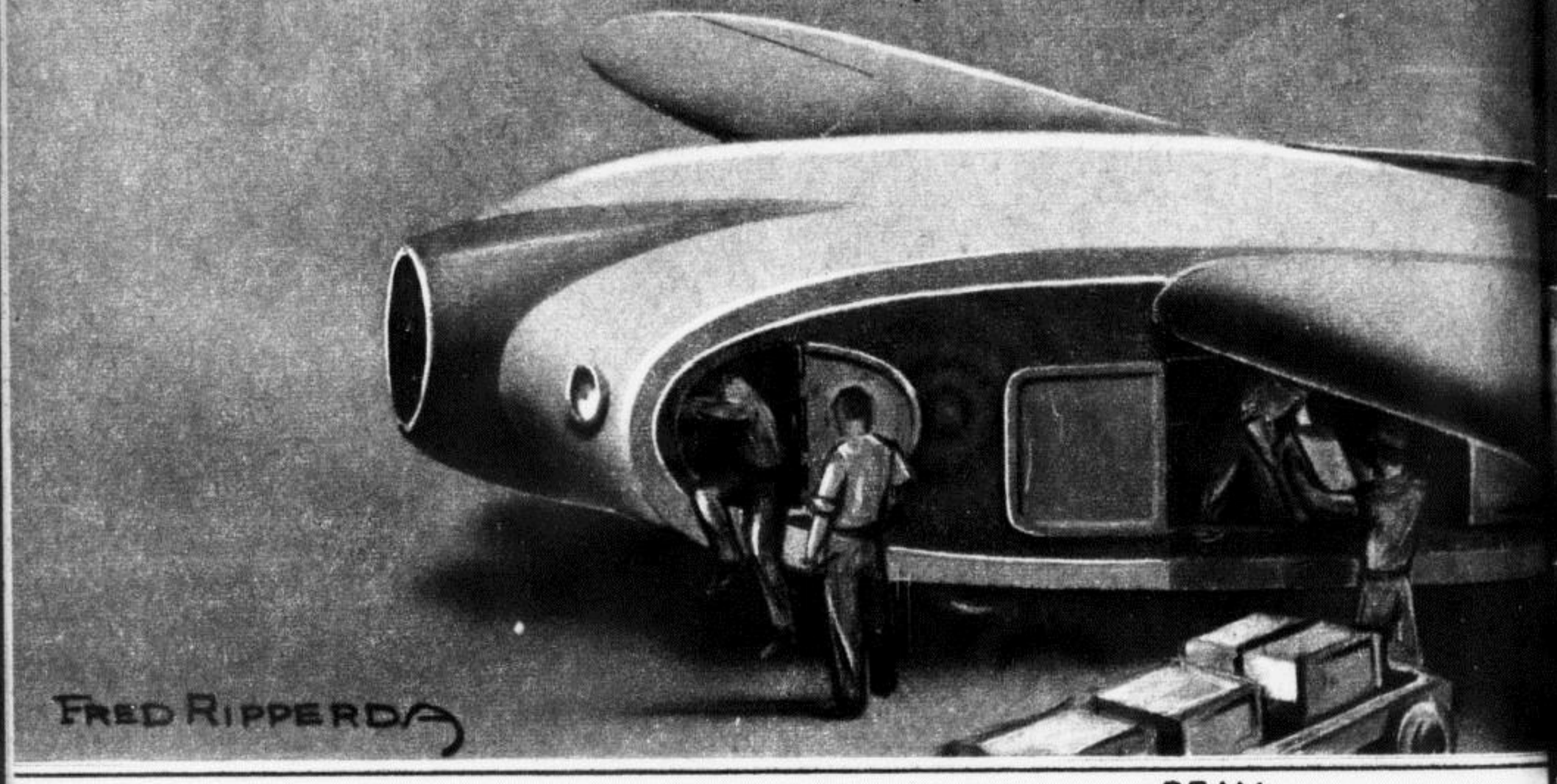
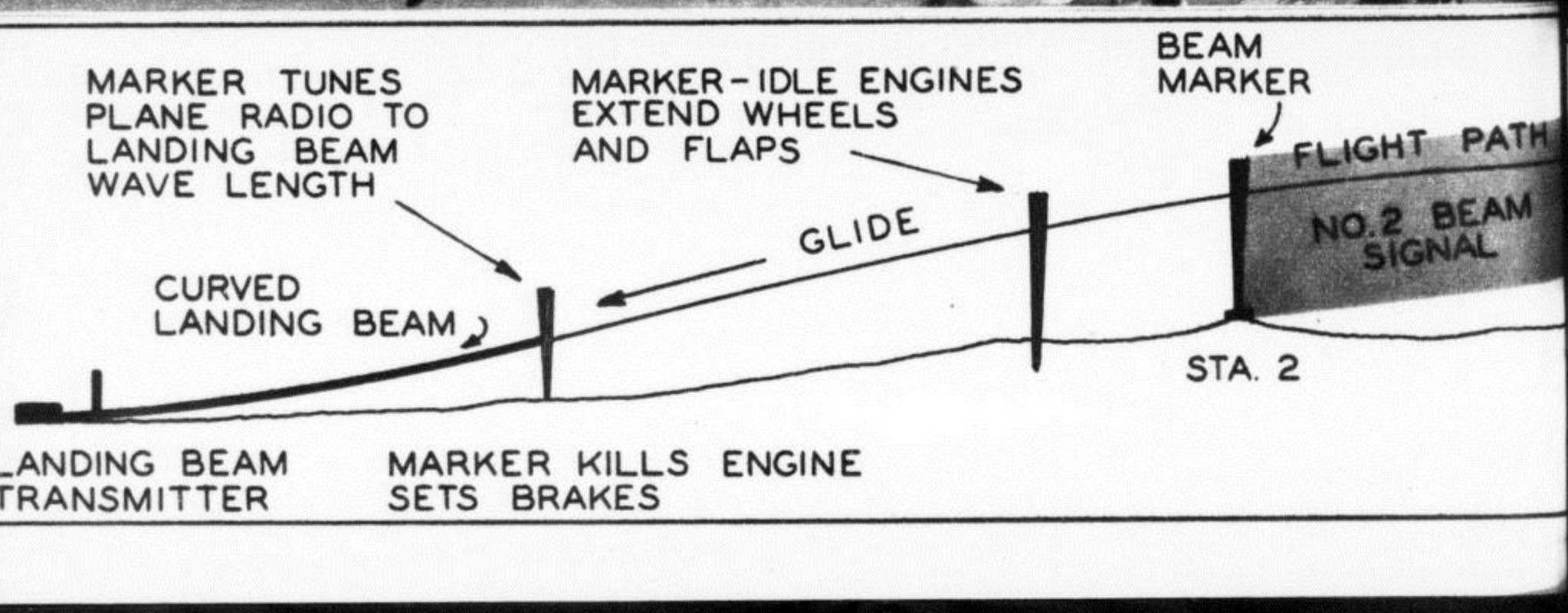
ROBOT AIR EXPRESS

BY ED YULKE

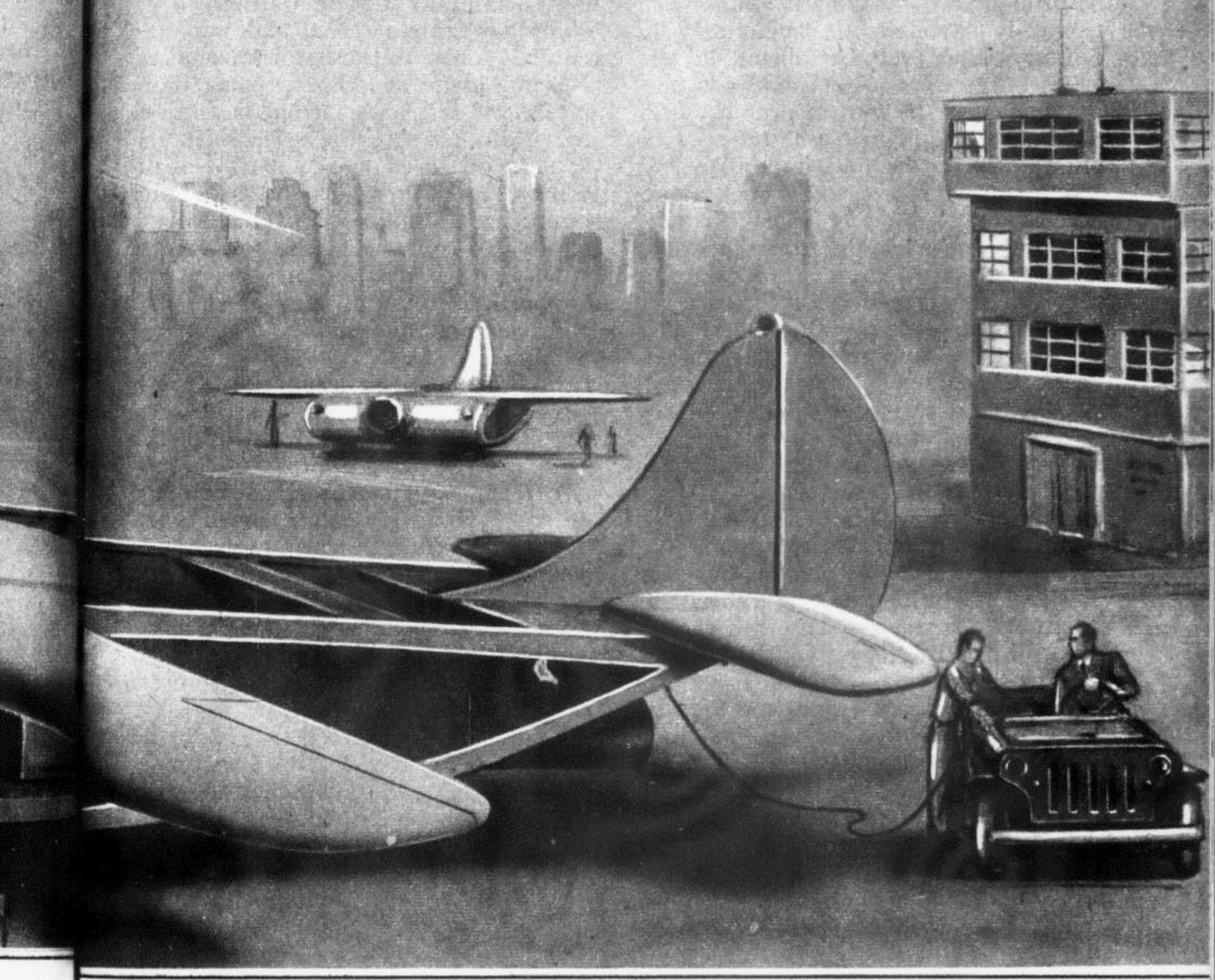


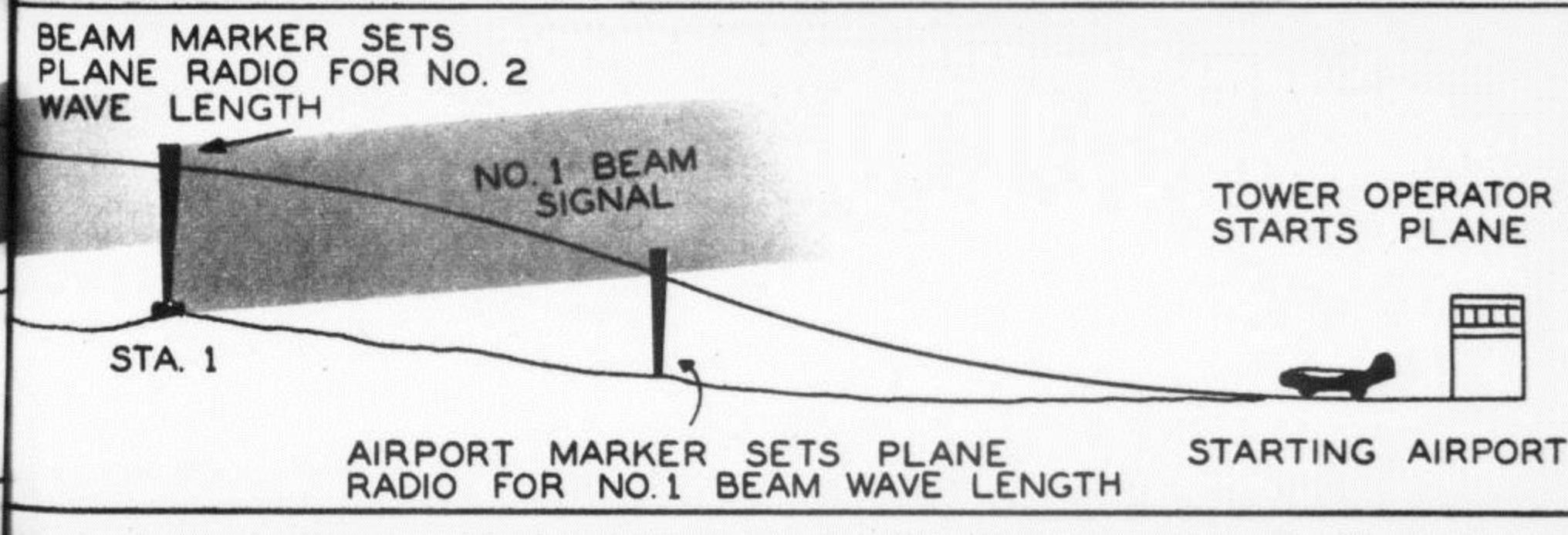


HUGE air-freighters for international cargo service, crewless and controlled completely by radar, have been made possible by the miracles of modern science.

It was quite a while ago that fiction writers predicted the aerial transport plying its way over the skyways of the world without a human being on board. Did they mean a ghostship? Not by any means. The ship wasn't described as an aimlessly wandering hulk—the stories told of a plane taking off from New York and sliding into a smooth landing at London, Paris or other world trade capitals under perfect control by radar.

Today those stories are no longer fiction. We've had radar-controlled planes for some time now. The tiny Culver





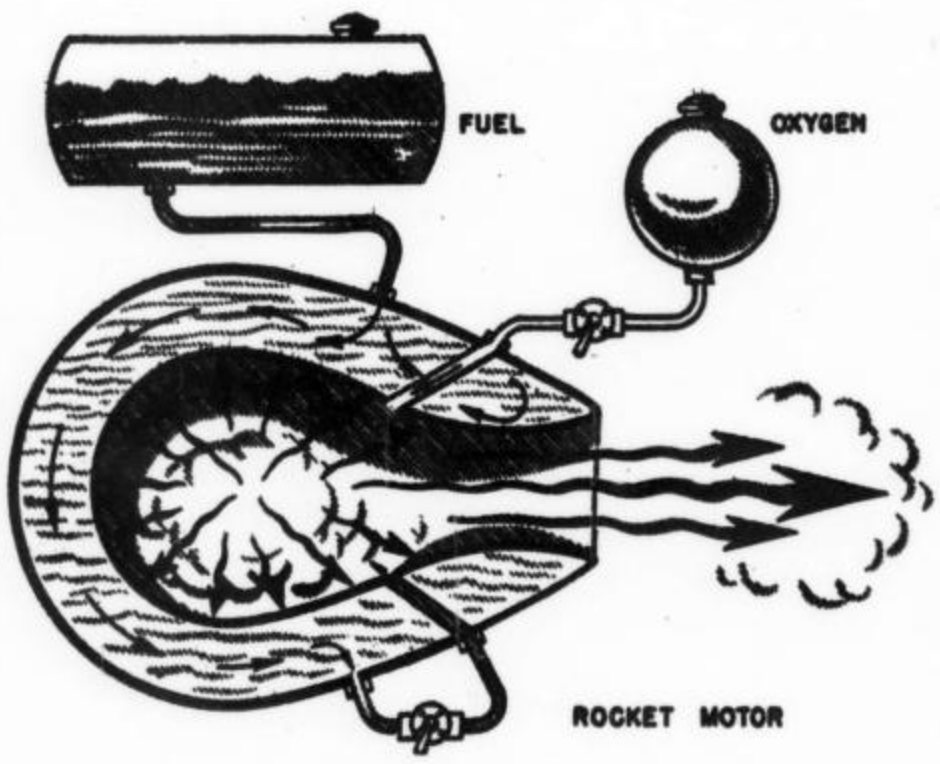
Cadets with their radar controls have made excellent target planes for anti-aircraft training throughout the war. No difficulty has been experienced in taking the ships off, flying them through any maneuvers, and bringing them gently to earth in a normal landing. Blind flying from the runway of one airport to the runway of another thousands of miles away has been accomplished without the pilot ever seeing the ground from take-off to landing. Automatic pilots, electronically operated, are being used by military planes every day during the war. Connect the three systems and you have the answer to the control problem from one end of the flight to the other—without a human being aboard the plane!

Suppose we see just how such a proposed system would operate. First, we need transmitters on the ground, spaced a suitable distance apart, marking the route the plane is to take. Each of these has not only a beam signal but also a local vertical signal of low strength, commonly called a "marker." This marker sends out a signal that is received in the plane's receivers only when the plane passes directly overhead, having been brought to the marker by the beam signal.

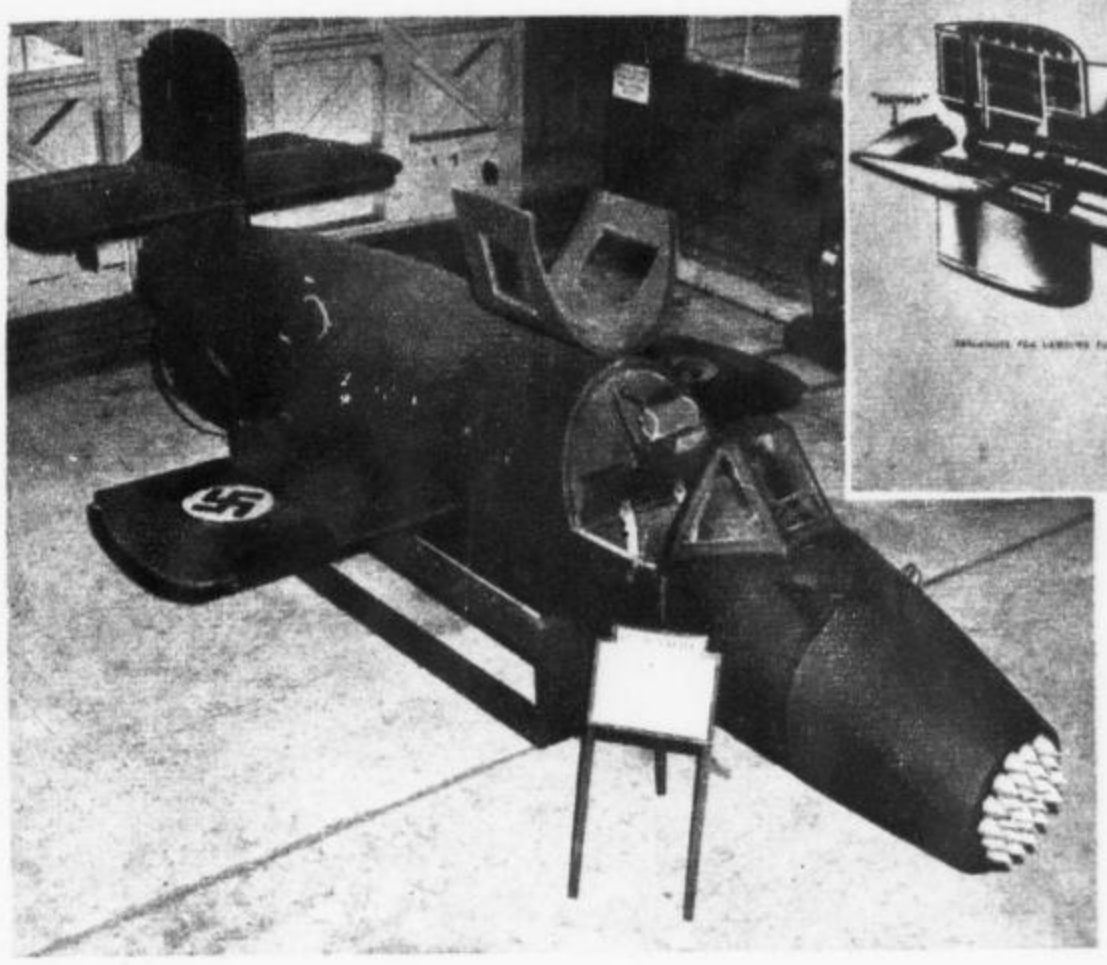
With this "air path," the plane is set in flight by the control tower operator at the take-off field. The plane is taxied to position at the end of the runway by ground personnel, and left with the engines idling. The tower man closes a key, sending out a radar signal that revs up the engines to take-off rpm. and the ship glides smoothly forward and takes off. In addition to operating electric motors that advanced the throttle, this radar signal also sets the auto pilot for a climb of a certain rate of speed. As the plane leaves the edge of the airport, automatically transmitted radar signals from the ground stations take over. A vertical marker transmitter at the edge of the airport sends a signal that is received in the plane as it passes over this point. This marker signal operates a selector in the airplane that sets the controls to follow a beam signal from a station hundreds of miles away, by changing the wavelength setting of the plane's receiver to the desired channel. The plane continues to climb, since the auto pilot has been set for a predetermined altitude. When the plane reaches this height, it levels off and the auto pilot keeps it level. The radar beam received maintains the required course to the beam transmitter.

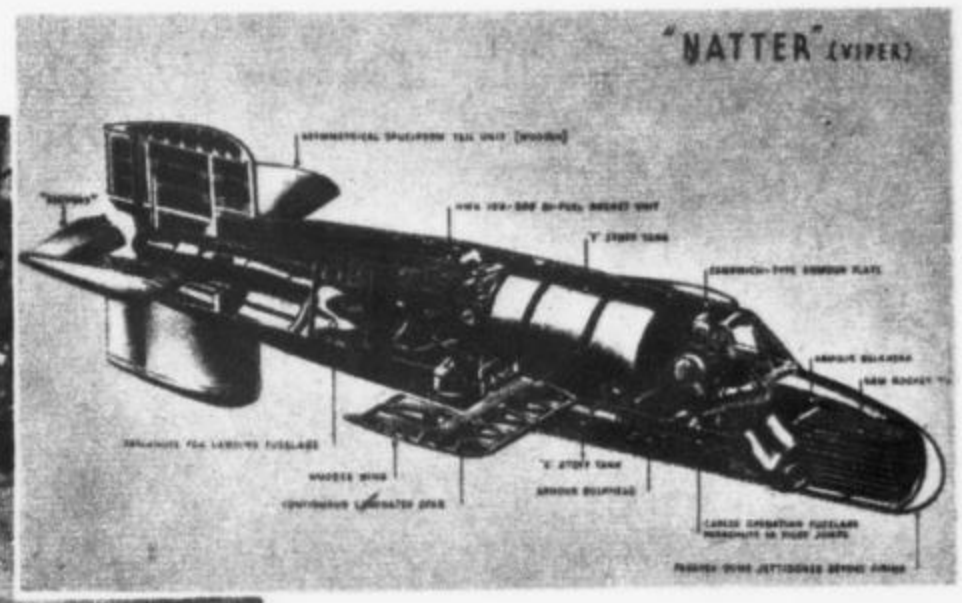
As the plane flies over the first beam transmitter, a marker signal is received that again changes the selector in the plane's receiver, changing the wavelength to the channel on which the next beam transmitter is sending a signal. The plane follows that course until the next marker signal changes the selector and so on. This can continue as long as the fuel holds out and the engines continue to function.

On arriving at the destination airport, a system of blind landing beams and marker signals takes over control of the plane. As the plane approaches the airport, a marker signal is received that cuts the engines back to idling, extends the flaps and landing gear, and places the plane in a glide to the airport. This first marker may be as much as five to ten miles away from the edge of the airport, necessary because the plane has to lose altitude over a reasonably long distance—there is no reason to dive it in like a V-2 rocket. The plane has now been placed in a glide path that will bring it over a second marker, this one perhaps only a mile from the edge of the runway. This marker signal changes the selector to a wavelength setting that will receive a signal known as the "landing beam," which originates at the far end of the [*Continued on page* 167]



Simplified drawing of motor used for robot plane take-off. Fuel, oxygen unite in combustion chamber.

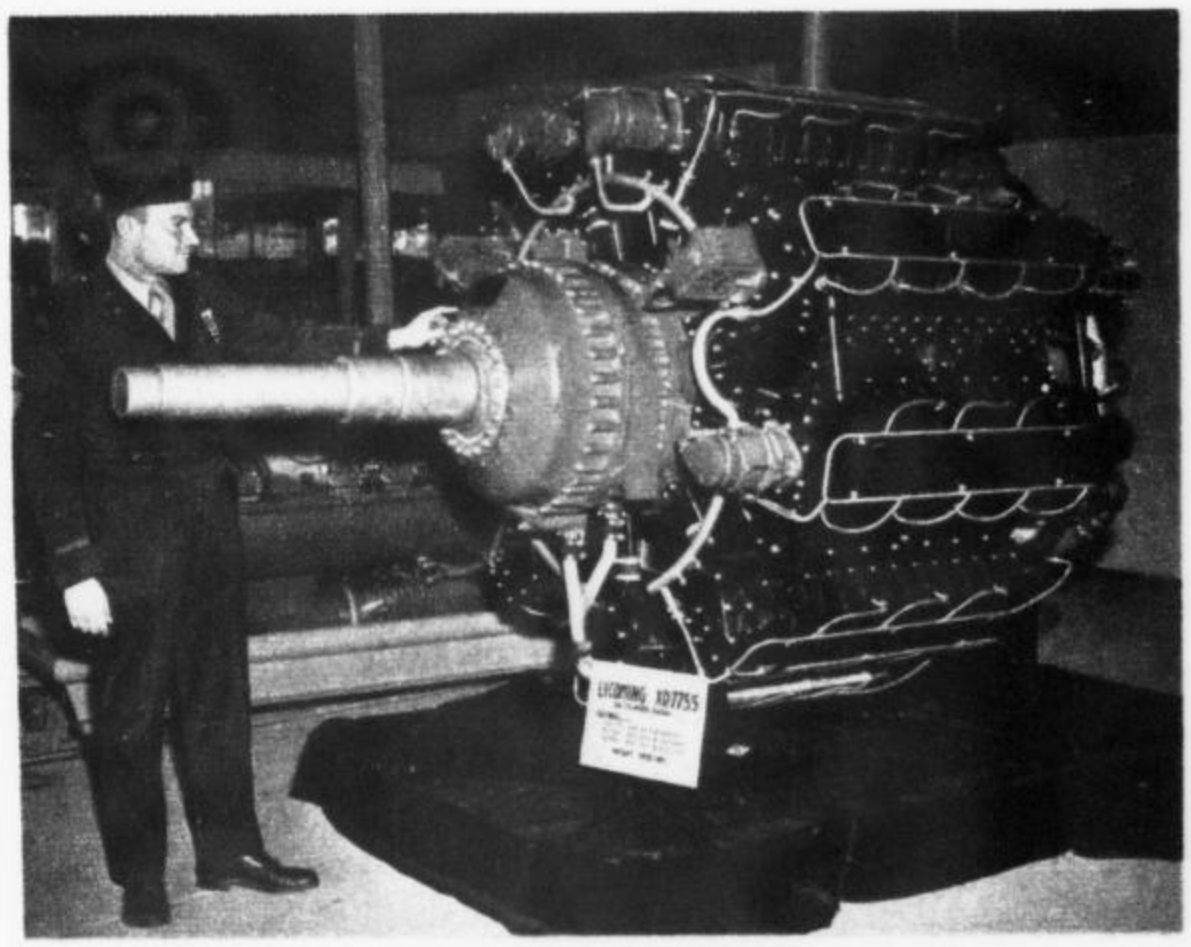




Nazi "Viper," a jet-propelled interceptor for one man, was designed to be launched from a vertical platform to meet oncoming bombers over Germany. After firing nose rockets, both pilot and expensive propulsive unit were to be parachuted to the ground. Plane had 24 rocket projectiles in nose for close range.

Peaches being treated with sulfa for disease is the newest use of the wonder drug. Agricultural scientists have discovered that seedling peach trees injected with sulfa become immune to certain diseases.

5,000 HP. is developed by the Lycoming 36-cylinder radial engine, almost one horsepower for each of its 5500 pounds of weight. Most powerful engine developed by the Power Plant Laboratory at Wright Field, Ohio, for the Army Air Force, it is too powerful for any existing plane. A special plane is being designed to fit it.



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Why Don't We Build—

FLYING RAM FIGHTERS!

If atomic attack comes, our best defense may be rammer planes that give the pilot a chance to survive.

By Martin Caidin

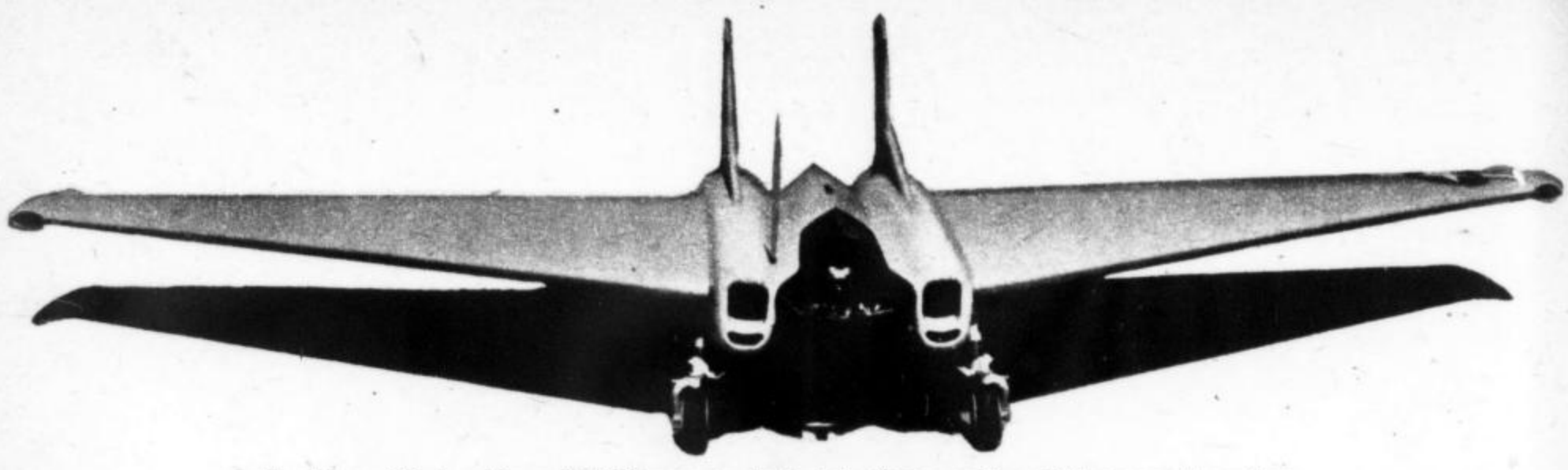
The rammer fighter—shown tearing into target—is our last hope for stopping planes that pierce our defense screen.

LET'S face it—the complete air defense of the United States is an impossibility.

Even with all-weather jet fighters armed with machine guns, rockets, and guided missiles; with rocket fighters; with unpiloted robot fighters; with supersonic rocket guided missiles; with radar picket ships and picket planes; with ground observers and a far-flung communications system, we can't prevent a certain number of enemy atomic and hydrogen bombs from hitting our cities.

We can, however, reduce the final number of enemy bombers which will break through our defenses. Just eighteen months ago, our nation was so naked to enemy air assault that Senator Stuart Symington warned: "—our capability to stop these bombs runs from a high of 20 percent under ideal conditions, to a low of less than one-tenth of one percent at low altitude or at night."

What has happened in the eighteen months since the Senator uttered his prophetic warning? MECHANIX ILLUSTRATED is pleased to report that, while our air defense still has a long way to go before it can provide the protection our cities require, a great many of the enemy bombers which once could hit their targets will never get past America's new aerial defense wall.



Northrop Flying Ram XF-79 was a twin-jet plane with pilot prone in wing.

Since early 1953 your Air Force has added many hundreds of new and deadly jet interceptors to its air weapons system. All-weather interceptors such as the F-94C, F-89D, and the F-86D have electronic "eyes" which can ferret out the location of enemy raiders in darkness or in storm weather. The supersonic North American F-100 and Convair F-102 are in mass production. Our interceptors are fast discarding their obsolescent machine guns and cannon for air-to-air rockets which pack devastating power. Air-to-air guided missiles which "home" on enemy aircraft are fast rolling off production lines.

Nike guided missiles even now are being placed about our critical targets. Boeing's F-99 Bomarc pilotless ramjet interceptor (see MI, August, 1954) is well into its development stage. New radar sites are springing up throughout Alaska and Canada. Long-range radar picket planes of the Air Force and the Navy patrol on 24-hour duty. And the Navy has received hundreds of new trans-sonic fighter planes.

Yet, with all these new, excellent weapons in our air defense system, too many enemy bombers still can get through to smash at our great factories and at our cities.

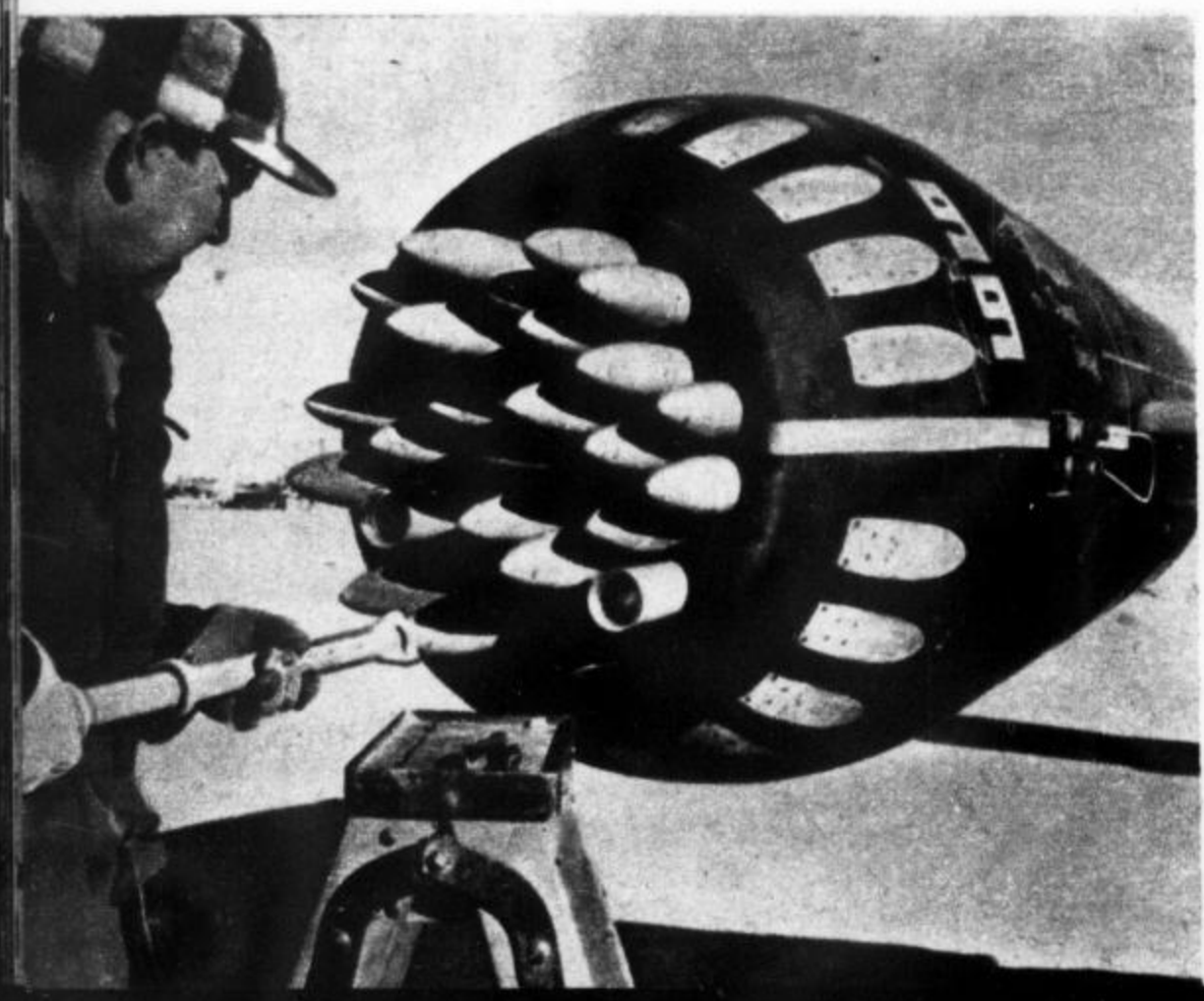
The perfect air defense is a pipe-dream; you can't stop all the attacking planes of an enemy force. The idea is to stop so many that you bring the attrition rate of the enemy's forces to forty, fifty, and, perhaps, even seventy percent of his attacking waves. Some bombs will get through, certainly, but the attrition rate can be made so costly that we can destroy the enemy's ability to sustain attacks against us.

Our new air defense weapons are geared to more and more electronic complexity. The pilot is fast becoming a human servant of the myriad mechanical and electronic devices in his interceptor. In many respects the pilot has been altogether eliminated!

In today's air war, electronics are a vital necessity. For electronics tie in together the many parts of the overall weapons defense system. A far-flung radar system, for example, is useless unless it has rockets and guns to back it up. And thousands of top-notch interceptors are useless unless

First photo of rockets being loaded into one of twin rocket pods of Air Force's Northrop Scorpion F-89D. Each pod carries 52 rockets.

Lt. Comdr. Harry Peck dons Navy's first full pressure flying suit, developed by Goodrich. Suit protects pilots flying above 50,000 ft.



they can be directed accurately to their targets.

A weapons system based on electronics, however, also is peculiarly vulnerable to what is known as jamming. It's no secret that there exists today a method for rendering ineffective through jamming techniques our early-warning radar. Jamming means that the enemy, at the crucial time, can render our electronic eyes blind.

Remember the famed "windowfoil" of World War II? To foul up German radar-directed heavy anti-aircraft guns, our bombers released thousands of tiny metal strips while pounding their targets. The twisting, fluttering strips reflected on the German radarscopes, completely neutralizing the heavy guns' radar-direction system. That's one example of jamming.

The more complex your defensive electronics system, the greater the danger of effective enemy jamming. The idea is not to become so completely dependent upon electronics that successful jamming will render our planes and guns "blind."

Recently an old concept of aerial defense has been dusted off for possible reintroduction into our air defense system. For a while after World War II we were so dazzled by the idea of radar and electronically-controlled flight that everybody assumed that the pilot—the human factor—was on the way out. In a matter of years, cried the experts, all our planes would be fully automatic and the pilot would be as dead as the dodo.

But is this true? Let's take a hypothetical air defense situation and see. We'll assume that an enemy force of twenty bombers is trying to hit New York, Washington, and Philadelphia in a high-speed, high-altitude attack. Early-warning radar pinpoints the enemy bombers, and our planes successfully intercept the attackers.

The air battle is swift and sure. From a position beyond the range of enemy guns, each fighter launches four air-to-air missiles which "home" on the enemy planes. Not all the missiles hit their targets; enemy jamming impairs the aim of several. Then the fighters close in, launching swarms of powerful 2.75 inch rockets. In a few minutes all ammunition is expended, and sixteen bombers are destroyed.

Sixteen out of twenty! Why, that's terrific! And we lost only three fighters. It's wonderful news, a smashing victory.

Wait a moment—what about the remaining four bombers? They are closing in on their targets, and each plane carries either an atomic or a hydrogen bomb. One hydrogen bomb may kill over a million people and lay waste the heart of a great city.

What can the fighters do—now? They've expended their rockets and their missiles. But those bombers are still up there, getting closer every minute to the millions of helpless people on the ground.

There is only one thing to do. Ram!

Deliberate ramming may be the most effective means of achieving the highest kill ratio of enemy bombers. One single fighter already miles high in the cold, sparse air of the sub-stratosphere is worth a hundred planes on the ground. Why should the effectiveness of this one plane, once it has expended its ammunition, be altogether lost? [*Continued on page* 217]

Doomed B-29 plummets earthward over Kyushu, Japan, after being rammed by a Jap fighter. Defense against rammers is almost impossible.

USAF Captain Edward Sperry plays guinea pig in testing automatic pilot ejection from plane hatch. Pilot's parachute opens automatically.